[Official Report.—Revised by the Secretary.]

SEVENTH ANNUAL MEETING OF THE OHIO GAS LIGHT ASSOCIATION.

Held at Zanesville, March 18 and 19, 1891.

First Day—Morning Session.

The seventh annual meeting of the Ohio Gas Light Association opened at Zanesville, Wednesday, March 18, 1891, at 9:30 A.M., the President, Charles R. Faben, Jr., in the Chair. The minutes of the last meeting having been published, the reading was dispensed with.

The President—The first business in order will be the reports of the committees, and of the Secretary and the Treasurer. The report of the Executive Committee will be read by the Secretary.

Report of Executive Committee.

The Secretary—Pursuant to instructions received from the Association at its last meeting I sent the following circular to each member:

"Dear Sir: At the recent meeting of the Ohio Gas Light Association, at Toledo, Ohio, the Secretary was instructed to ascertain the views of each member as to the adoption of a badge, more or less similar to those that have been adopted by the other Associations, and for the same purpose—viz., for the members to wear at the annual meetings and on other appropriate occasions.

"Will you please fill in the blanks below and return this to me at your earliest convenience?"

In the circular I asked three questions: (1) Are you in favor of the adoption of such a badge by the Ohio Gas Light Association? (2) Should the badge be furnished to the members and paid for by the Association; or should each member who desires one pay for his own badge? (3) About what should be the cost of such a badge? The vote in favor of the adoption of a badge stands 107 to 12; that each member should pay for his own badge, 69 to 39; while the cost of the badge is fixed at $3 by the majority of those voting. The Committee recommend that a committee of three be appointed by the Chair to select a badge, to ascertain the number of members desiring one, and to provide and furnish badges to such members, together with a sufficient surplus to supply new members who may come in hereafter. The second recommendation of the Committee is that the written withdrawals from membership by the following members (for the reason that they are no longer in the gas business) be accepted: W. T. Bowers, Hillsboro; R. Turner, Salem; F. F. Remple, Jr., Logan; T. C. Jones, Delaware; E. H. Crane, Niles; F. Fabing, Fremont. The third recommendation is that the following members be dropped for delinquency in the payment of dues: Richard Salter, Covington, Ky.; John Devor, Greenville, Ohio. The Committee's fourth recommendation is that the Association elect to honorary membership Forrest E. Barker, a member of the Massachusetts Gas Commission.

The report of the Committee was adopted as a whole.

The President—As Mr. Barker is present with us, we would like to hear from him; and I take much pleasure in introducing him to this body.

Mr. Barker—Mr. President and Gentlemen: This is indeed a surprise to me—a very pleasant, but also somewhat an embarrassing one. I assure you I appreciate the very cordial greeting that I have received at the hands of those members of the Association whom it was my good fortune to know before I came here, and also from those whom I have had the pleasure of meeting since my arrival. I assure you, also, that I sincerely appreciate the honor you have been pleased to do me by electing me to honorary membership in this Association. I am sure it is a compliment which no one who has any connection whatever with the business in which you are engaged would decline. I wish to congratulate you, Mr. President, the officers of the Association, and the Association itself, upon the very good attendance which is here; and I trust that you will have a very pleasant and a very profitable meeting. I was attracted here largely by the reputation of the Ohio Association, and by the practical and very interesting topics which have been announced for discussion. I know you are all interested in them and are anxious to deal with them, and as I also am very desirous to hear them dealt with, I will not take up any more of your time. I do desire to thank you again, and most heartily, for the honor you have conferred upon me, and I trust that I shall have the pleasure of making the acquaintance of a very large number of the members individually.

Committee on Badges.—The President appointed the following Committee on Badges: M. A. Gemuender, J. W. R. Cline, and G. A. Hyde.

Committee on Applications for Membership.—Also the following Committee on Applications for Membership: W. W. Cantine, L. A. Strong, and George H. Tayler.

Report of Secretary.

The Secretary read the following report:

In hands of Secretary at beginning of year		$136 00
Received as dues and initiation fees		451 00
Total credits		$587 00
Remitted to Treasurer, Mar. 25, 1890	$175 00	
" " May 6, 1891	175 00	
" " Mar. 16, 1891	159 00	
Total debits		509 00
Balance in hands of Secretary		$78 00
Dues for 1889 still unpaid	$33 00	
" 1890 "	84 00	
" 1891 "	261 00	
Total dues unpaid		$378 00
New members admitted at last meeting		33
Released from membership at last meeting		9
Elected from active to honorary membership		1
Present number of active members		151
Present number of honorary members		9
Number of active members deceased during year		0
Number of honorary members deceased during year		1

Respectfully submitted, Irvin Butterworth, Sec.

Upon motion the report was accepted.

Report of Treasurer.

Mr. McCook read the following report as Treasurer, which was, on motion, accepted:

Receipts.

1890. Mar. 26.	H. Wilkiemeyer, Ex-Treasurer		$1,028 99
" 27.	Irvin Butterworth, Secretary		175 00
May 13.	" "		175 00
1891. Mar. 17.	" "		159 00
	Interest on $600.00, 10 months, 5 per cent.		25 00
	Total receipts		$1,562 99

Disbursements.

1890. April 15.	Irvin Butterworth, salary	$200 00	
	" expenses	59 93	
	Ohio State Journal Company, printing	87 75	
	Mansfield Gas Light Company, expenses 5th annual meeting	76 42	
	W. C. Hedges, postage	6 24	
	Geo. A. Halm, printing	48 50	
	Edw. Lindsley, printing	11 00	
May 13.	" " expenses	6 50	
	Toledo Gas Light Company, expenses of 6th annual meeting	155 19	
1891. Mar. 17.	Exchange on N. Y. draft	90	
	Total disbursements		$652 43
	Balance in hands of Treasurer		$910.56

Respectfully submitted,
George W. McCook, Treasurer.

Election of New Members.

Mr. Cantine—The Committee on Applications of New Members are ready to report. They present the names of Geo. H. Phillip, Supt. City Gas Works, Hamilton, O.; H. D. Timmons, Supt. Barnesville (O.) Gas and Electric Light Company; V. H. Harris, Supt. Fostoria (O.) Light and Power Company; Frederick H. Shelton, Gas Engineer, United Gas Improvement Company, Phila. Pa.; Henry M. Hubbard, Sec. George M. Clark Stove Company, Chicago, Ills.; W. G. Bissell, with the same Company; Wm. S. Essick, Prest. Keystone Meter Company, Royersford, Pa.; and Sterling F. Hayward, Treas. Connelly Iron Sponge and Governor Company, New York city—all being gentlemen of the first order, and proper persons for election to membership in this Association.

On motion, the Secretary was directed to cast the ballot of the Association for the election of the gentlemen named. The President introduced and welcomed the new members.

ROLL CALL.

The Secretary called the roll, which disclosed the presence of the following members:

Honorary Members.

Jos. R. Thomas, J. P. Harbison, Geo. W. Graeff, Jr.

Active Members.

Adams, C. F.	Hammond, A. N.	Penn, Jerome.
Allen, G. A.	Harris, J. A.	Persons, F. R.
Bate, Jos. M.	Hedges, J. S.	Prichard, W. W.
Booth, Miller.	Hurlburt, H. L.	Printz, Eugene.
Butterworth, Irvin.	Lathrop, A. P.	Roots, D. T.
Canby, R. H.	Ley, W. S.	Russell, E. M.
Cantine, W. W.	Light, Geo.	Sherrard, R., Jr.
Christian, G. H.	McCall, Hugh.	Sisson, F. N.
Clapp, G. N.	McCook, Geo. W.	Skinner, J. W.
Cline, J. W. R.	McIlhenny, John.	Smith, J. H.
Dell, John.	McMillin, M.	Stephens, J. G.
Dickey, C. H.	Matt, Geo.	Strong, L. A.
Douglas, H. W.	Marden, C. A.	Tayler, G. H.
Faben, C. R., Jr.	Mills, John.	Welch, C. H.
Faux, J. A.	Nash, A. F.	Wilkiemeyer, H.
Gwynn, J. W.	Osius, Geo.	

PRESIDENT'S ADDRESS.

The President then read the following address:

Gentlemen of the Ohio Gas Light Association:

Again are we assembled in convention for the purpose of conferring with each other upon the various points of interest pertaining to the business that we represent. Our membership is composed of individuals from all parts of the State, together with many from our sister States, and among the same are enrolled individuals who represent gas light companies, in the various offices and capacities, from that of President, down through the various positions to that of, I might say, the most humble "hired man."

Surely, in such a gathering, a large fund of valuable material is brought into close contact, and much good ought properly be the result of such a meeting, no matter what the nature of the question be, that seems at the time to interest each individual most.

If the question presented happens to be upon the subject of a particular line of policy or business practice, we have among our number those who are eminently well qualified to disscuss such matters, or if the question be one of what constitutes good practice in the manufacture and distribution of our product, then we have present with us those who are equally well qualified to discuss this particular feature of the gas business proper; hence, I say, there is no good reason why these yearly gatherings should not be almost directly profitable to all who participate in them.

It is hardly proper for me to occupy your time and attention with any sort of argument, but I feel constrained to point out some of the features of our Association meetings as I comprehend them, and for particular reasons.

It has been stated by some that to read over the published proceedings of our meetings is sufficient, and quite as beneficial as though the time and expense of attendance at the meeting had been resorted to. This I believe to be a great error. Who of us but have oftentimes communicated to others in private conversation matters of interest and importance, private in their nature, that we could not consistently communicate, if the same was to become public property, as it would become were it to appear in the published reports of our proceedings?

The literary part of the programme of our meetings I think is differently understood by different persons, and this difference of understanding does perhaps in a large measure account for the stubborn unwillingness on the part of the majority of our members to consent, under any circumstances, to contribute a paper to be read and discussed before the meeting. This action on the part of the members is entirely wrong, and results in making the work of our Secretary extremely arduous, and were he less zealous and persistent in the work of securing contribution to the literary part of our programme, that feature of our yearly meetings would be extremely tame. Then, again, since so many do refuse to contribute a paper, they seem to hesitate in a like manner to participate in the discussions that should properly be provoked by the reading of many of the papers that are presented.

To my mind, the general principles involved in the gas industry are well understood and distributed, and in asking a member to present a paper to be read and discussed, it is not expected of him that the paper so presented will amount to a "revelation." We are met simply as the employees of capital invested in the gas industry, and some portion or detail of this investment is intrusted to our individual care; and to the end that we may avoid some of the mistakes that others have made, we have come together to hold an "experience meeting," and, therefore, our expressions should be full, free and complete, so that the purpose for which we have come together may be speedily accomplished.

We are not a scientific society, nor are we investigators, who labor to find new forces and factors; we are simply, as before stated, the active workers for the various gas light companies that we here individually represent, and the details that we pratice in our business and have found to be correct in operation—that is the material brought together here today, and only by a full, and free expression can we turn this valuable material to proper account, and accomplish the full purpose for which we are met.

The proper committee of our Association met and selected a number of subjects, that, in their opinion, would prove most interesting at this time. To a few of them, the Secretary has succeeded in obtaining authors to write upon the subject assigned. It is unnecessary for me to make extended reference to the subjects that will be presented for your consideration. That the presentation will be made in a strong manner there is no room to doubt.

In regard to the work accomplished by the Association during the past year there is little to report upon, aside from the reports that have been rendered by the several committees to whom such work has been assigned.

The past year has not been prolific in the production of new processes, nor have the many recognized processes, methods and practices experienced serious changes, or improvements, but there has been a general improvement in many directions, and the points of merit presented in the different processes and methods are better understood and appreciated. Much of our former prejudices have been dismissed, and we are no longer known among ourselves as being strictly coal gas or strictly water gas men, but rather as modern, progressive gas manufacturers.

The general condition of the gas industry at the present time is certainly encouraging. Realizing and appreciating the inroads that have been made, and that are further likely to be made upon the volume of gas consumed in the field of lighting, have resulted in awakening the people in charge of the gas industry to renewed effort in cheapening the cost of production and distribution, improvement in the quality, and securing to themselves a continued good market for their product.

To secure these ends requires constant study and application on the part of the persons who are charged with the responsibility of securing success for the plant in their care. No opportunity could afford to be wasted, no argument presented but that must be met and successfully combatted.

Somewhere I have read, yet I cannot now give the author nor the source, words that I recollect about as follows: "Humility is all very nice, but don't practice it to the exclusion of the other virtues. A little self-assertion counts for much. We are rated just a little below our own estimate. If you tell the world that you don't count for much, they will take you at your word, saying that you ought to know. He who is silent is forgotten; he who does not advance, falls back; he who stops is overwhelmed, distanced, crushed; he who ceases to grow greater becomes smaller; he who leaves off, gives up. The stationary condition is the beginning of the end; it is the terrible symptom which precedes death. To live is to achieve a perpetual triumph; it is to assert one's self against destruction; it is to will without ceasing, or rather to refresh one's will day by day."

The sentiment expressed in these words is the spirit that must prevail in the minds of those who would succeed in our day, and in no situation will the principle apply better than in the business life of organized gas light companies and that of their servants.

The subject of municipal ownership of gas and electric light companies is now receiving considerable attention at the hands of thinking people, and strong argument is presented by those who favor it, as well as by those who oppose it. While I recognize that each one of us holds strong convictions upon this subject, and appreciates the importance of the question presented, yet I still believe that little good can result by any action on the part of this Association in declaring itself upon the issue. In fact, I think the effect would be otherwise.

We are here as practical men in the gas business, and are in no sense moulders of public opinion, nor are we to consider ourselves as a factor in politics, and, therefore, the less of this outside material we attempt to discuss the better. Our verdict can have no good effect upon the proper authority, and possibly might create friction instead.

The subject of gas for fuel is receiving much attention at the hands of gas light companies in a number of cities and towns throughout our country—special rates for all gas consumed for fuel purposes have been

made, and in a number of situations the rate has been made unusually low. The arguments made in the premises you are all quite familiar with, so that I need not cite any of them; but, from the number of gas light companies that are now making special effort in the fuel field, we ought a year hence, if the results are properly compiled, be enabled to make valuable deductions for the guidance of others who may hereafter elect to make the experiment of furnishing illuminating gas at special low rates for fuel purposes.

The use of gas engines, as a source of motive power in small domestic motors, is not progressing as well as we might wish. The electric motor possesses strong advantages over the gas engine. From the fact of its being a rotary engine, its use can be applied to the upper stories of large buildings. The electric current can be applied to a large number of motors in the same building, applying the power almost direct, thereby saving the amount of power that is usually wasted in long lines of shafting, belting, etc.

The applicability of the use of electric engines to the upper stories of buildings, where the rent charged for the premises is less, and the further fact that where a like amount of power distributed throughout a building with a gas engine as a source of motive power would demand that the engine be placed upon the ground floor, where the rent for premises is much higher, all contribute against the more common use of the gas engine. As an illustration, the ground floor of a building may be very desirable for large offices or for retail business purposes. The rent charged for this floor may be, say, $1,000 per year. The fourth floor of this building may be a very desirable location for light manufacturing purposes, and the rent is only $300 per annum, but it cannot be supplied with power, as no other power is used or demanded in the building. A gas engine will not apply in this situation, but the electric motor will apply perfectly.

The difference in the rent charged for the fourth floor and that of the first or ground floor, will enable the occupant of the fourth floor to pay a premium for the electric power, as he can save more than the premium paid in the charges for rent.

The subject of the World's Fair has received attention at the hands of the American, Western, and also the New England Gas Associations, and has resulted in their appointing a committee from each of those Associations, the committees so appointed to form one general committee. The Ohio Gas Light Association have not as yet appointed a committee to act for them in the general committee above described. I would suggest and heartily recommend that, during the present meeting, a committee be appointed, with instruction to co-operate with the committees of other Associations to represent the Ohio Gas Light Association in the general committee.

I feel I cannot urge too strongly upon you the importance to our industry of securing earnest and active efforts by such committee to the end that the gas appliance part of the exhibition may be entirely creditable and beneficial to the gas apparatus manufacturer, and also to those engaged in the industry of furnishing gas to cities and towns throughout our country.

There is no question but that the electric light industry will be thoroughly represented, if, indeed, it does not prove to be a strong feature of the exhibition.

It would be pleasant, indeed, could I close my address to you this morning without making reference to the death during the past year of a most respected member.

It has pleased the Almighty to remove from our midst one whom we so respected and admired for his many qualities that, of all others, we elected him as being most fit to head the list of honorary members of our Association.

In accordance with our custom, it is fitting that a committee be appointed to draft suitable resolutions of respect to his memory, and that the same be spread upon the records of our Association; and, also, that a copy of the same be forwarded to his family.

Before closing this address, I want to thank you sincerely and heartily for the great honor conferred in electing me to preside over your deliberations at this meeting. It shall be my effort to serve you well, and if I fail, it must be charged to my weakness, not my intent.

I now declare this seventh annual convention of the Ohio Gas Light Association open for the transaction of such business as may properly come before it.

COMMITTEE ON PRESIDENT'S ADDRESS.

On motion of Mr. Graeff, the President's address was referred to a committee of three to take into consideration and report upon the recommendations contained therein. The following committee was named by the Secretary: Geo. W. Graeff, Jr., Fred. R. Persons, Chas. H. Welch.

The Secretary announced that he had received letters of regret from Frederic Egner, St. Louis, Mo.; Richard J. Monks, Boston, Mass.; Eugene Vanderpool, Newark, N. J.; Jas. Somerville, Indianapolis, Ind.; A. B. Slater, Sr., Providence, R. I.; C. F. Prichard, Lynn, Mass.; Henry B. Leach, Taunton, Mass; C. F. Blodget, Brooklyn, N. Y.; Walton Clark, Philadelphia, Pa.; W. H. Denniston, Pittsburg, Pa.; Chas. H. Nettleton, Birmingham, Conn.; A. C. Humphreys, Philadelphia, Pa.; W. H. Pearson, Toronto, Can.; A. M. Norton, Nashua, N. H.; Louis Wagner, Philadelphia, Pa.; A. Hickenlooper, Cincinnati, O.

Telegrams of regret were received from C. H. Evans, Chicago, Ills.; Geo. Shepard Page, New York City and Emerson McMillin, St. Louis, Mo.

READING THE PAPERS.

Mr. H. W. Douglas thereupon read his paper on

THE PROPER HANDLING OF OXIDE OF IRON IN PURIFICATION.

In the purification of gas by dry means, whether by lime or by oxide of iron, these desirable points present themselves:

1st. The gas should remain in contact with the material as long as possible, *i. e.*, as low a velocity as possible should be maintained in the purifiers—only obtainable by a generous area of boxes.

2d. The material should present as great a surface as possible to the gas.

3d. The material should be of such a nature as to give a minimum back pressure.

The accomplishment of these ends in the use of lime was very thoroughly treated by Mr. Forstall, in a paper read before the American Gas Light Association, in 1875, in which he showed that by a treatment of the lime so as to form it into small globules, not only was the back pressure greatly reduced, but a marked increase in the purification per bushel was noticed. In four years the depth of lime was increased from 12 inches to 54 inches, while the pressure was reduced one inch, and the purification efficiency was increased from 7,700 cubic feet to 22,000 cubic feet per bushel.

Were the cost of oxide the only expense, the increased surface and time in contact with material could be obtained by deepening the layer of oxide; but this increases the labor in changing, and does not increase the purification per bushel.

In the use of artificial oxide, made by rusting iron turnings and filings with copperas water, I have had no experience. It is clear that the best results will be obtained when the iron is quite fine, and rusted in the presence of sawdust, so as to deposit oxide of iron on the surface of the sawdust.

In the use of natural oxide the desirable points indicated can be obtained by having the oxide finely powdered, and mixed thoroughly with sawdust while damp. The finer part of the oxide will adhere to the surface of the sawdust, making a larger surface of contact and rendering the whole mass more porous. The sawdust should be quite coarse, and that obtained from soft wood sawed across the grain is most desirable. Should screens be used the proportion of sawdust need only be very small. If the unmixed oxide be put on the screens about 3 inches thick, very good results as regards back pressure can be obtained, and there is, of course, considerable less material to handle. The labor in placing screens will amount to more than the increase of labor in handling a greater bulk of material when sawdust is used.

To illustrate the effect of a varied velocity of the gas in the purifiers, and the evil effects of a high velocity, I have endeavored to collect some data, the results of which are shown in this table. The actual purification per bushel cannot be taken as a basis of comparison without considering the amount of active purifier present; but the ratios of purification at different velocities are perfectly comparable.

Observation.	Size of Boxes.	Daily Output.		Purification per Bushel.		Ratio.	Velocity per Hour per sq. Ft. Purifier Area.		Ratio.
		Maximum.	Minimum.	Maximum.	Minimum.		Maximum.	Minimum.	
1	16′ × 24′	410.0	170.0	966	2,156	2.23	44.4	29.4	2.27
2	20′ × 24′	830.0	375.0	1,700	2,000	1.17	72.4	32.5	2.22
3	20′ × 24′	1500.0	600.0	1,665	4,666	2.80	132.8	52.08	2.53
4	8′ × 10′	36.9	15.1	8.6	11.8	1.37	191.2	78.8	2.42

It will be noticed that the ratios of purification at maximum and minimum are not in proportion with ratios of velocity. A high velocity does not seem to cause a high ratio of purification; No. 2, with a velocity of 72.4 feet per hour, has a ratio of 1.17, and No. 1, with a velocity of 44.4, has a ratio of 2.23.

The following instance illustrates the desirability of a uniform velocity in the purifiers: Two works making water gas are run by the same company, and the same materials are used in both. In one a relief holder has been placed between the generating and purifying apparatus, so that a constant velocity is maintained in the purifiers, and the result is that a purification of 6,000 feet per bushel is obtained, where 4,000 cubic feet is obtained without the holder. The constant velocity with the holder is higher than the mean velocity without.

The revivification of the oxide should be as deliberate as possible. The lid of the box being raised, the box should be allowed to stand as it is some hours. The strongest ammonia gases will thus pass off and render the work of removing the material less uncomfortable.

Should screens be used, it is well to remove the center one in each layer, allowing the air free access to all parts of the box. Oxidation should not be hastened, especially before removal, as too great heat will ensue. Should the heat reach a dangerous point, I can see no harm in throwing on water, as it will only assist in the oxidation. The oxide should be sufficiently dried before replacing, so that it will not cake.

When removed and spread in the air, it should be shoveled up or turned over at least once. Sufficient material to fill at least five boxes is desirable, so that greater time and more complete revivification may be had.

In large works, the labor of changing may be facilitated and cheapened by a system of conveyances and elevators.

Discussion.

The President—You have just heard a very interesting paper read, and its suggestions are now before you for consideration and discussion.

Mr. Christian—I would like to ask if any members have had experience in revivifying oxide when it would not revivify? That is, have any members had a film of oil to form on the iron in such amount as to prevent the iron from revivifying? Sometimes coming out of the boxes black in color, it will not thereafter change its color at all. I would like to know if there is any way in which that film can be gotten rid of, except by taking it out before it gets there? Is there any way that we can get the oil out without injuring the material?

Mr. Douglas—In order to do that we put a layer of sawdust at the bottom. The sawdust will absorb a good deal of it. I do not think there is any way of getting it out after it once gets into the oxide, except to burn it out.

Mr. Christian—If it were washed down pretty thoroughly with water, would it have any effect? I have had a great deal of trouble this winter in purification with oxide of iron, and it has been caused either by the oil or by something that I do not know about. I cannot see the oil on the stuff; it does not show as tar; and yet it will not revive. I wheeled a lot out last January and dumped it in a pile, and the air, snow and rain have acted on it, and it is in splendid looking condition; but when I put it on the floor in a thin layer and turned it over, it would not change its color. After being out doors awhile in the rain, snow and sunlight, it shows a beautiful color; so that I think it can be wheeled back and used over again.

Mr. Hammond—Do you have any difficulty in getting it heated up?

Mr. Christian—Yes, when it is thrown on the floor, and then spread out to the air, it retains its dark color.

Mr. Hammond—I have had difficulty in getting it heated, but have remedied it by sprinkling with copperas water, when, after being used for a short time, it would revivify again all right.

Mr. Hayward—This is my first attendance at your meeting. I represent the Connelly Iron Sponge & Governor Company, of New York. We sell a good deal of oxide for purification, and the only difficulty that we have encountered with it, among engineers and superintendents in handling the oxide, is of the impression which has gone out that air revivifies the oxide, and that it is absolutely necessary to have it spread out very thin. Now, the chemical action takes place thoroughly (as I think Mr. Douglas will agree), when the oxide is heated up; and in order that the chemical action can take place, it must be spread very deep, at least two feet thick, so that from the chemical action taking place, and the air acting upon it, it will heat up to such a degree that the oily vapors accumulated will, to a certain extent, pass away. For that reason, the thinner you spread your oxide for revivifying the worse it will be. Another thing, the oxide should not be put out of doors; it should be kept under cover, and where it is not exposed to the rain. We have found that that is the best way of treating it. A gentleman here spoke of having put it out of doors in a heap. If it was revivified, it was owing to the fact that it was put in a large heap, instead of being spread out thin on the floor.

Mr. Clapp—I think a mistake has been made with regard to the instructions. The instructions, as I understand them, are to spread the sponge out in the same thickness that you have it in the purifier. Is that not correct?

Mr. Hayward—Yes.

Mr. Clapp—Now, if we put it in the purifier to a depth of six inches, according to those instructions we should spread it out on the floor six inches deep in order to revivify.

Mr. Hayward—I will say that usually in giving directions for the use of the oxide, we instruct that the layers in the boxes should be at least a foot and a half thick, instead of six inches; and that agrees with my first statement with regard to spreading it out. Better action is secured in that thickness. It is entirely different from the handling of lime. It i not spread in so many trays in a box. If any instruction of that kind has gone out it was unbeknown to me. I will say that in using the oxide it is of very vital importance that the tar and oily vapors be kept from it. These are very detrimental to it, as all must know who have used it. A thin layer of sawdust should be used on the lower tray, or, if sawdust cannot be procured, we find that coke breeze is very useful for that purpose. If that is not available, spent lime will answer the purpose very nicely. So you see that there are plenty of things that can be used to prevent, or rather to take out, the tar and oily vapors before they reach the oxide. When you have trouble in this respect, do not blame the oxide in purification, but be sure that your scrubbers are all right.

Mr. Christian—I would like to ask if anyone has had experience in blowing air with their gas through the oxide by a steam jet, and in such a way that the steam does not all condense, but is passed out with the air through the oxide. I would like to know if that would have any bad effect on the action of the oxide?

Mr. Thomas—This question came up in the New England Association at its last meeting; but the trouble there was from the back pressure. A number of gentlemen stated that the lower part of the box would be coated quite hard, sometimes half an inch, and often at greater thickness. One speaker who had had a great deal of trouble in his purification, stopped in our office last week, and, in talking over the thing, said he had been using sawdust, but had lately changed to the use of coke. In the bottom of the box he places a layer of small coke, covers it over with bags and lays the oxide on top of the latter. He has been operating in that way for about a month, during which time he has had no trouble with reference to the back pressure. As a matter of course, all the oily substance will thus be kept out of the oxide.

Mr. Bate—I have been using oxide for about four years, running as high as 225,000 feet of gas per day through 8x10 boxes. I use fine breeze on the lower tray, cover that with a lot of bagging, and then above that put two trays of oxide—the lower one being about two feet deep, and the other about 18 inches deep. There is very little space between the first and second tray. We have had no trouble in that time from oil getting into the sponge. We clean out all the breeze about once a month. I am making almost an unlimited use of oxide by putting copperas water on it. We finally have to throw it away, because it becomes too heavy.

Mr. Faux—In my experience in the use of oxide I have had some difficulties. I have lost some through improper treatment. I find the best treatment that I can give the oxide, when it is taken out of the boxes, is to pile it 3½ or 4 feet thick on the floor, and let it lie there until it becomes thoroughly heated—not hot enough to burn, but so hot that you cannot bear your hand on it. Then I spread it out on the floor, less than one feet thick, and during the time it is revivifying I turn it about three times. I have had but little difficulty getting the oily substance out of it. I have used both breeze and sawdust in the first tray. I fill my boxes to the depth of about 28 inches, and I use no tray in the box except one right above the sawdust. I sometimes am troubled when it gets to caking. Then I get scrap tin and burn the tin off, putting in enough scrap tin, and find I have no trouble then in any way. In doing that I get rid of the trays, and have the box filled from the bottom to the top with sponge. I have no trouble with my back pressure.

Mr. Printz—I think I must have misunderstood Mr. Faux. I understood him to say that he placed it 3½ feet deep. Does he mean in the purifying box, or when the oxide is placed on the floor for revivification?

Mr. Faux—The first time we place it on the floor for revivification, it is about 3½ to 4 feet deep.

Mr. Printz—My experience in purification with oxide of iron has not been a very pleasant one. I have endeavored four or five different times to use it, but it has always proved a failure, and we have had to return to the use of lime. I have used the Connelly sponge, and have used other preparations, but they failed with me each time. I have been

given to understand that the failure was because I did not try it long enough; that I must not expect it to do its work the first or second time it was placed in the box. To satisfy myself I was not wrong in that direction, I last year used a material for some three months. I could not afford to use it in all the boxes, because I could not change my purifiers fast enough if I did. I used the oxide in one, lime in the next, and iron in the next; but during those three months we used just as much lime as we did during the same three months of the year before. One advantage we had was that we had to pay a little more for the labor, because we handled the oxide without any benefit. Why I have that trouble I fail to understand. The first time I gave the trial to any preparation of that kind was with Mr. McMillin's preparation of grindstone dust. He came here himself, after I had tried it, and had had trouble with it, and spent three or four days with me—that was during the time he was located at Ironton. He finally gave it up, and found he could not make it answer. I afterwards procured a lot of the Connelly's sponge, and had the same sort of failure. One of the Messrs. Connelly came here, spent three days with me, and was obliged to give it up. Mr. McMillin and Mr. Connelly both came to the conclusion that our boxes were too small; that if we increased the size of the boxes, we would have no trouble—at the time we were using boxes 5x6. We afterwards increased the size to 8x10, but with no greater success. During the last year, four of my purifying boxes have been 10x20. We were only running at that time about 100,000 feet per day. So you see the area of our boxes was away above the average; and yet we had no better success. We have about settled down to the conclusion that it is the coal which causes the trouble; although persons around here are using native coal of the same kind that I am using. I would like very much if I could be put on the track in the right direction for using the oxide of iron. At present we are using lime, and I must say it is pretty expensive. Our purification, for labor and lime alone, runs up to 6 or 7 cents per thousand feet.

Mr. Hammond—I have tried to pass air through the sponge while making gas, but not successfully. I found the difficulty was in getting so much air with the gas that it reduced the illuminating qualities. Our boxes (we use native coal, which has about 4 per cent. of sulphur) are very small, 3 x 3, and require a good deal of changing. To overcome that difficulty, I have attached an ejector by which, when one box becomes foul, I turn off on that, force in the air and steam, revivify it, and then turn it back again. That will revivify about as well as if the sponge had been taken out and put on the floor, and we get good results in that way.

Mr. Welch—I did not understand Mr. Printz to say just what the trouble was. He said he tried the oxide of iron purification repeatedly, but did not say whether the material did not purify enough, whether it took too much of material, or whether it purified imperfectly. I would also like to inquire what material he used.

Mr. Printz—The difficulty was that it failed to take up the impurities. The sulphureted hydrogen would pass over. We are using the native coal which we get here within the city limits. It contains from 3 to 5 per cent. of sulphur.

The Secretary—Mr. Douglas said that if the oxide should reach too high a heat in revivifying, he saw no harm in throwing on water, as it will only assist in oxidation. My teaching has been that that was dangerous, as it has been known on occasions, at least, to stop the process of oxidation, not only at that time but for all time for that material. I would like to ask if he has himself thrown cold water on the hot oxide of iron while revivifying?

Mr. Douglas—I have not, and never had occasion to. I should think it would be necessary to take it out of the boxes as soon as the water had been thrown on it.

Mr. Phillip—I have had some experience with the oxide. Our works are new. We started last May. At the time the works were completed there was no preparation made for a place to properly revivify the oxide, and we had the trouble that the gentlemen speaks of—by the formation of a tarry or oily substance on the bottom of the box. We run three boxes (10 x 10) with oxide, and one box with lime. Our space for revivifying was too small. We could not clean our gas, and we could not clean our oxide. I caused to be erected a porch extending out from the purifying house, 12½ feet by 41 feet. That was made of wood, with sliding glass windows, 5 by 4 feet in size. We put in a brick floor and ran a series of hot pipes around on it, so that in the cold weather of this winter, when throwing the sponge out to revivify, we kept it warm by passing steam through the pipes and getting the brick floor thoroughly heated up. When it gets too hot we shut off the steam until the temperature goes down. So far we have had very good results. I would like to know if any one else has had the same experience in the matter of getting too much heat. I can say very frankly that I am getting the oxide back to its original condition again quicker than I have been able to do in any other way. In pleasant weather, or in weather such as this, we can use that room by sliding the windows back, and when it is too cold, we help it along by steam heating. We put that on the brick floor, from 2 to 2½ feet deep, and turn it every day. In the morning, when the man comes in his business is to turn each batch in order. We have had first rate results so far. Whether I am over the trouble or not, I cannot say. Whether we are likely to meet with bad results hereafter is what I would like to find out. I will say, however, that so far I am doing well. We are getting our sponge in pretty good condition, and putting it back again. As to our lime boxes, the last one is on its third week. It is 10 x 10, with two layers of lime. This coming Saturday that lime will have been in three weeks. We change it once a week, one box at a time; but as soon as one is cleaned out and the other box fouls, we turn right on again.

Mr. Hayward—How much gas are you purifying per bushel?

Mr. Phillip—Our average run is 110,000 per day of 24 hours. We are using all the boxes. As soon as one is cleaned we turn it on again.

Mr. Hayward—How deep are they?

Mr. Phillip—Four feet—we are running two layers of oxide. I think one is 13 or 14 inches, and the other is 12. You will recollect that we had to send you a telegraphic order for sponge. That was caused by the tarry substance forming in two of our boxes at one time, which caused us to be very short of oxide. We telegraphed an order to your firm, and in the meantime we ran on three boxes of lime until we received the oxide from you.

Mr. Douglas—Did I understand Mr. Phillip to say that he changed the purifiers every day, and got 110,000 feet between changes?

Mr. Phillip—No; we do not change the purifiers every day, but that is the yield of gas that we send through the purifiers.

Mr. Douglas—How much do you make between changes?

Mr. Phillip—We are using it all the time. As soon as one box is cleaned, we put it right back again.

Mr. Douglas—How often do you change the boxes?

Mr. Phillip—About once a week, or oftener if a box becomes foul. That is governed a good deal by the coal we use. Some coal has more sulphur in it, and that requires the boxes to be cleaned more often; others will run longer.

Mr. Cline—I would like to ask if any one has had the sponge to take fire when it is heating, and I ask the question because I have a poor place to put my sponge in for oxidization. I put it in the cellar, and I have had some fear of its taking fire. It is in a bad place if that should happen.

Mr. Bate—Once when I left the sponge too long without turning it over it got to a nice, hot glow. After that we were more careful in turning it. We pile it up two or three feet deep, and then turn it over as soon as it throws off a blue smoke, showing signs of heating. We do that eight or ten times a day. I would not recommend the sponge to be left in any place where it could set fire to anything.

Mr. Christian—Will the shavings and copperas burn unless iron filings are put into it—just the plain shaving?

The President—The percentage of iron would determine the degree of oxidation. The more rapidly it oxidizes, the hotter it will get.

Mr. Christian—Can you get it so strong as to set fire to the shavings without putting iron in it?

The President—Yes; we have been using a preparation of iron and sawdust for purification since 1873, and nothing but that, save one tray of lime in each box. I have had some of the experiences related this morning, and among them that of the oxide taking fire. In our earlier experiences we thought if a little iron was good a little more iron was better. We now use about 60 per cent. of iron turnings in the mass. On one occasion a purifier was changed late in the afternoon and its cover raised, and by 9 o'clock the box was on fire. We put it out by lowering the cover and excluding the air. We remedied any difficulty of that kind by adding a material which was a poor non conductor of heat, in the form of very coarse sawdust. Our practice led us to the adoption of a formula for making a material out of very coarse sawdust and iron turnings, in the proportion of about 94 per cent. of the former to 6 per cent. of the latter, by volume, wetting the whole mass down with a saturated solution of sulphate of iron. As Mr. Printz has suggested, it does not do as well at first as it does afterward—at least we did not find it so; but the reason it did not do as well, I imagine, was because the iron was not distributed as well over the surface of the wood. In handling the material we take it out of the purifier on to wheelbarrows, and dump it in a pyramid form—our boxes are 16 by 24, and 3½ feet deep, and the contents of a box will make a pile of oxide of iron

material in the yard possibly 6 feet high and running off at the full angle of repose, and of the proper length to accommodate the quantity. We leave it in that form. If the percentage of iron were in excess, it would heat too hot and char the wood, which would tend to make it too fine and undesirable as a mixture. We put in a percentage of iron sufficient to bring on the heat necessary for ready oxidation when exposed and piled in that form. Mr. Christian said something about introducing steam in the mass, and asked if there was objection to that. I think not. The presence of moisture is desirable, as it assists in the absorption of the sulphureted hydrogen of the gas that passes through. The principal point in the use of iron in purification is ample surface permitting the gas to pass through slowly. I do not think that the oxide of iron acts as rapidly as some kinds of heavy caustic lime.

Mr. Clapp—My experience might do some one good. Having had back pressure with sawdust, I afterwards mixed fine shavings or chips with it, since which time we have had no trouble. Our old boxes were small ones. and since we put in larger ones we have had no trouble at all. If those having back pressure on the boxes will run a lot of pipes around the retort house, they will get rid of it.

Mr. Cline—As our Secretary has had some experience with purifying material I think it would be interesting and profitable to the Association If he would give us the benefit of it.

The Secretary—I do not know exactly what material Mr. Cline refers to.

Mr. Cline—Grinsdtone grit.

The Secretary—That experience we have had in common with many others. With us it has been satisfactory. At Columbus we get it very cheap—only $1.50 for a big wagon load. It revivifies satisfactorily. We have used it without any admixture of sawdust whatever, putting it in just as we receive it. I was a little surprised to see how little back pressure there was. Indeed, I cannot see much difference between its efficiency and that of the material we purchase. We have tried the Douglas mixture and that of the Messrs. Connelly.

On motion of Mr. Cantine, a vote of thanks was passed to Mr. Douglas.

Opening the Question-Box.

The President—Perhaps we can best devote the short time before adjournment to the consideration of some of the questions that have been presented through the question-box. While the list of questions is being distributed I will ask if any gentleman present has had any experience which will enable him to answer the 17th question:

"*What is the best paint for lids of purifying boxes?*"

Mr. Printz—I would take that question not to mean really the top of the lid, but the sides or edges. I can say I have found it best not to use paint at all, but crude oil. We place on top of the water in the channel or canal a layer of oil, probably three quarters of an inch in depth, and occasionally smear a little with a brush around the sides of the lid. We have no trouble with rusting.

The Secretary—I have tried what is known as the Triumph Graphite Grease—a very cheap mixture of grease and graphite—on the rods and girders of the puryfying house roof, which were much exposed to the corrosive vapors rising from the boxes, and rusted very rapidly. Having difficulty in stopping the rusting, I procured and applied the graphite grease, and it has answered very satisfactorily in keeping the rods from rusting. I purpose trying it in the sides of the purifying box lids, and am fully satisfied that it will be very efficient there. I speak of this not by the way of advertisement of the grease, but as a matter of interest and information.

Mr. Cantine—I wish to say I fully coincide with Mr. Printz's statement with regard to painting the sides of purifying lids. I have tried pretty much everything, but never could make anything stick. The water will loosen it. Corrosion underneath the paint will cause the latter to scale off in sheets. I think oil is the best thing to use, as it absolutely prevents corrosion, which is all that is desired. Coating the top of the lid is all a matter of taste. As to painting the iron work, girders, and all that sort of thing, I do not know of anything that is better for the purpose than coal tar and turpentine. It neutralizes the sulphuric acid, and makes just about the hardest substance that you can coat iron with.

The President—The first regular question is—

"*Which is the better method of condensation, 'open air' or 'water'—leaving out of consideration the space occupied and the cost of apparatus?*"

Mr. Thomas—I think air condensation is the best. This process is in a manner like the gas going through the boxes to be purified—the slower the process the better. When tubular condensers were introduced the work was done in a very quick manner, but I do not know that it was done any better. I always contended that the more air condensers one had about the works, the better would the gas be purified. Slow cooling causes the operation to be more complete. Many parties operating works seem to want to get down as quickly as possible to a low temperature. I never liked getting the gas about the works below 60°. In some very old styles of gas works condensing pipes were placed wherever there was a possibility of putting them, and I think the work was done quite as effectually as it is done to day by these complicated condensers. In them the gas passed through a series of pipes surrounded with water, and fresh water came in at the same time to reduce the temperature. I think the slower the process is carried on the more effective it will be, and the better will be the results obtained.

Mr. Harbison—I am not competent to answer the question directly, for I have not had a very large experience in open air condensation, although that was our mode of condensing when I first became connected with the Hartford gas works, a number of years ago. They were then not very extensive, neither was the make of gas; but when we outgrew those works we put in a multitubular condenser. Since that time we have grown still larger and added air condensation, in the form of a large and long take-off pipe in the retort house—a 20-inch main running along the retort house wall. Hence I may be said to believe in both systems of condensation. Our plan works satisfactorily. Our apparatus is quite sufficient. Having put in what I considered sufficent for one million daily capacity, and as our maximum has not been over 625,000, I have no trouble at all in passing the gas slowly through the process of condensation in a very satisfactory way.

Mr. Clapp—This is a meeting in which we can all be benefited by learning the experience of others. I have probably not been in gas works so long as many others here, but I have had the benefit of an experience in four or five different gas works. My experience has been that air condensing is far better than water condensing. I think it is better for the very reason that has been stated—it is slower, is very simple and cheap, and can be effected by running pipes around in such a way as to get all the cocdensation needed. In my experience I have had the best results from air condensation.

Mr. Nash—Will not the naphthaline trouble be less with air condensation than in multitubular condensation?

The President—Will some gentleman kindly answer Mr. Nash's question? Can Mr. Harbison tell us?

Mr. Harbison—Will he kindly tell me what naphthaline is? (Laughter.)

The President—I think that is satire.

Mr. Harbison—I did not mean it to be taken as satire, because it is not so intended. Years ago I did know what naphthaline was, but, as matter of fact, we do not have a particle of it now. We have had none during this entire winter. In fact we have not seen the slightest indication of it about the works or outside of the works, and yet we are still in the business of making gas. I should have said a moment ago, by way of expressing preference as to which is the best method of condensation, that I believe that water condensation is better than air. Of course I speak only from experience in my own location. With us we have at times a variation of 40° in temperature within 24 hours, and if the condensers are exposed to the atmosphere, your condensation will vary very greatly under such conditions. In water condensers you are better able to control it.

The Secretary—At our works we take up the variations in atmospheric temperature by bye passing certain of the condensing apparatus.

Mr. Harbison—That would accomplish the purpose.

The President—I think Mr. Nash's question has hardly been answered.

Mr. Nash—I thought probably a slower method of condensation would tend to reduce the naphthaline.

Mr. Bate—I have used water condensation, and am now using air condensation, principally. I think the use of air condensation prevents the precipitation of naphthaline, as it usually occurs in works.

Mr. Thomas—I have seen, where multitubular condensers were used, the gas, coming from the hydraulic main at 130°, and only traveling a short distance, knocked down to 40°. Such sudden changes tend greatly to produce naphthaline. In most of the original so-called air condensers the pipes were laid underground, so that if the external air temperature did drop 40 or 50°, the temperature in the ground probably would not vary 5°. Down to a certain depth the ground does not vary very much in temperature. In the passage of the gas through the pipe the temperature might be changed, but not to any material extent. As I said before, we never cared to get our gas below 60°. We ran along, as Mr. Harbison has stated to be the case in his works, free of naphthaline, and did not know the why or wherefore. We did not have it when our neighbors were troubled greatly with it. The first experience I had with it was when I put in the multitubular condensers. It would stop up the

four inch pipes in the condenser so frequently that once in two weeks we would have to clear them all out.

The Secretary—How close was the multitubular condenser to the hydraulic main? How hot was the gas before it entered?

Mr. Thomas—The gas issued from the exhauster at about 125°, and entered the condenser at a few degrees less; but I presume it was close to 125° when it entered the condensers. When we put our first standard scrubber in we made the connection to it directly from the exhauster, and the temperature there was generally 125° at one end and 115° at the other. Then it passed through the condenser. We afterwards changed it, running it through the condenser and bringing it back; which ran it down to about 75°. The main thing I think in the manufacture of gas is the slow process of its movement. The more condensers you have and the larger purifying surface, the better will be your results. In speaking about purifiers, some odd sizes have been mentioned here. My idea has always been to have the purifier nearly square, say about 24 feet long and 20 feet wide, and about 4½ feet deep.

The Secretary—My information is that the place where gas can stand sudden reduction in temperature with the greatest impunity is close to the hydraulic main. We have at our works a multitubular condenser placed close to the hydraulic main; and we cool our gas say from 200° to 130° or 140°, at the multitubular condenser, without any formation of naphthaline. Like Mr. Harbison, we do not have naphthaline now.

Mr. Thomas—What is the temperature of your gas at the hydraulic main?

The Secretary—That I do not know, but I think it must be the same at our works as at others. It is certainly very much higher than 130°. Since it emerges from the multitubular condensers at a temperature of 130°, it must have been 300° or 400° close to the hydraulic main.

The President—We are drifting a little from the main question, which is, "Which of the two methods is the better?" and in order to get the sense of the meeting we will take a vote. Many members do not seem disposed to give their experience, hence by taking a vote we can find out which is the better according to the sense of the meeting. Those of the opinion that open air condensation is the better will signify it by standing up, and vice versa. It is decided by vote of 11 to 5 in favor of open air condensation.

Mr. Shelton—Where does the combined system come in on this voting?

The President—We will take a vote on the combined system—that is, the open air and multitubular together. As many as are of the opinion that the combined system is the best will rise. The sense of the meeting seems to be that the combined system is the best. The next question is: "*How can retorts be prevented from getting coated with carbon?*" As the eighth question is related to this, we will discuss the two together. It is—

"*What is the best method of burning carbon from retorts?*"

The Secretary—One fruitful source of the deposit of carbon in retorts is the pressure. If you can remove the gas from the retort as it is generated, so that it will not back up and be at pressure there, the carbon will not deposit as rapidly as if it were under pressure.

Mr. Cantine—The best way to get rid of carbon is not to make it—not to allow it to deposit. I use a rod, ⅝ inch in diameter, put on a spatula, 4 inches in width and 5 or 6 inches long, to remove the carbon. Carbon commences to form in the shape of a moss on the crown of the retort. If you scrape that off at the start you will have no more trouble. Your retort then has become absolutely coated and filled with corbon. The porousness of the retort causes the deposit of carbon. Decomposing it becomes a hard cake, like the cake made from the residuals of petroleum. It is just as easy to prevent its getting there, and very much less trouble, than it is to get the coating off after it once burns on. By putting in the carbon burner you can burn the carbon all off clean, but after the next few charges you make you will get very little gas from the retort. The carbon commences to again form immediately. I have noticed that a retort after being burned out, in two weeks would be as bad as before. I have two benches of fives at work, and have no carbon in any one of the retorts. We have never burned any one of them out. We have never had the carbon burned in them. I grant you that a little carbon will form at the corners right at the back end of the retort, but, by leaving the lids loose for 12 hours, you can easily scale that off and pull it out. There will be two pieces, perhaps 2½ feet in length, and probably four inches in width. I once had a man in the works who was always burning out the retorts, but I never had to do it. I think you will be benefited by that plan. It is a very simple thing to do, and will work as well on retorts without an exhauster as where there is one. You cannot entirely obviate the pressure. You must have some kind of a seal, either of water or tar; and whatever effort it costs to push the gas through that seal will add to your carbon and make so much back pressure.

The President—How long have those 10 retorts been in operation without any deposit of carbon?

Mr. Cantine—Since the 10th of August, when they were put in new.

Mr. Hurlburt—Is Mr. Cantine still working on the retorts where carbon has once formed and been burned off?

Mr. Cantine—Certainly; just as well as with the new ones. You will find a new one just as porous as one which has been burned out.

The President—Mr. Smith, how do you free your retorts of carbon when it has once formed?

Mr. Smith—We burn it off with steam and air.

Mr. Printz—Will Mr. Cantine say how often it is necessary to do this scraping or scurfing; after every charge, or once a week?

Mr. Cantine—After the pores are all filled up, you will hardly find it necessary to do it once a month. In the commencement it will be necessary to do it as fast as it forms. Whenever you see it on the retort, scrape it off; it will not take more than three or four minutes to clean it all off, and it does not hurt the retort a particle to remove it. All the books say you must not use a bar in a retort. I would not use a big one; but this little rod will do no harm. It will not harm the retort in any way.

Mr. Bate—Mr. Cantine remarked that he would let the retort stand for 12 hours. Perhaps he may be able to let one of his retorts stand for 12 hours—although perhaps occasionally he may drop his charges—but we that have to crowd our retorts during the whole time have no opportunity or time to do any scurfing.

Mr. Cantine—That is very true; but our experience is not at all like yours. We are not so crowded. Since the introduction of the electric light we sometimes have time to let one retort stand for awhile. What would you do in the event of your retorts becoming so filled with carbon that you could not use them? Would you not be obliged to stop and clean them out with your carbon burner? Hardly a gas works would have much trouble from this source if the retorts were spared occasionally. Of course this trifling carbon deposit in the back end would not give very much trouble, but if it descended from the crown of the retort, so as to affect the weight of the charge or the placing of the latter, it would be a great obstacle.

Mr. Nash—Will the anti-dip—taking the pressure away by that means—prevent the formation of carbon?

The President—It would somewhat remove the liability; but my experience is heartily in accordance with the opinion expressed by Mr. Cantine. When your retorts are once filled so that there is not any escape of gas through the pores, there is no longer great liability to the deposit of carbon. When the carbon is once deposited in the moss form that Mr. Cantine speaks of, that carbon not being a good conductor of heat, its temperature is lower than the temperature of the retort; hence, when the lid is closed and distillation begins, carbon will deposit on that colder surface rather than flow off. The consequence is that it rapidly builds up, whereas if the moss is kept scraped off the liability to the deposit of carbon is much less. That is clearly evidenced in favor of use of iron over clay retorts in the matter of the deposit of carbon. The next question is:

"*What should be a fair allowance for shrinkage in both coal gas and carbureted water gas, as indicated by difference between station meter and aggregate of consumers' meters?*"

That is, what is a fair allowance for condensation and loss on account of the shrinkage of the gas itself? I have no doubt this question has been a serious one to many of us here, and I would like to have expressions from members on the subject. Can we hear from Mr. McIlhenny?

Mr. McIlhenny—I have been actively out of the business of gas making so long that my opinion is not worth a great deal. I believe in coal gas we hold that about 4 per cent. loss of bulk is due to condensation proper. I would like to have a statement respecting similar loss in water gas.

Mr. Shelton—This question seems to me to come right down to the consideration of what is a fair leakage account. Of course, shrinkage in either case is but a part of the leakage. Comparing coal and water gas in that way, I have recently had occasion to look into the matter in connection with the paper which I shall have the pleasure of presenting to you later on at this meeting, and I have availed myself of some experiments made by Dr. Moore, some six years ago, with a good water gas. I say a good water gas, for the reason that, like everything else, there is good and bad water gas. A great many of the earlier forms of water gas would hardly be called a good gas. It was thought to be, but was not when you applied the test of condensation. In brief, the rea-

son was this: The superheating capacity of those earlier water gas plants was too small to properly fix the constituents of the gas together. Water gas being a mixed gas, made from water and the evaporization of oil, it must be made permanent; and if that is not done you will have trouble, because the oil will separate and condense. I am very sorry to say many of those old forms of apparatus are still in use, and I do not doubt that condensation with them is much greater than in coal gas. Taking the modern water gas, made with the modern apparatus, built on proper plans and in proper proportions, you will find practically no difference. That was shown by Dr. Moore's experiments which I have given in the paper. He found, briefly, that, if anything, when properly made, water gas had a little advantage over coal gas. It is a small fraction. I would like to ask one further question. I did not know it had been determined that 4 per cent. was the amount allowed for shrinkage in coal gas. So many factors come in—such as difference of temperature, leakage proper, and the condensation of different gases due to temperature—that I think it probable the definite amount named is about right for coal gas.

The Secretary—I do not know how Mr. McIlhenny would account for the statement, but the Secretary of our Company (Mr. Lathrop) saw, in a report of English Gas Companies, that some works were rated as having the entire leakage—condensation, leakage and all—as aggregating only 5 per cent.

Mr. McIlhenny—That might be answered in the same way as the showing of some companies in this country—who apparently sell more gas than they make.

The Secretary—Whose meter did they use?

Mr. McIlhenny—The temperature at which it passed through the consumer's meter has been greater than the temperature at which it is delivered at the station meter. That might make some difference. Again, the temperature of the ground in summer time might be such that the gas would pass into the houses expanded. As to my authority for the 4 per cent. loss or absolute shrinkage of bulk in coal gas, I really cannot for the moment say; but I know it is so stated in one of the standard books. I take it for granted that the figure is understood to apply to gases measured at equal temperatures. I have never myself tested it. There is no other question connected with the gas business that the superintendent can address his attention to with the same profit to his company as to the lessening of leakage. Nothing can be worse than to make a thing and waste it. Waste is bad under any circumstances; waste is forbidden in all kinds of economies; and gas *leakage* is a pure waste. A great deal of gas is lost in transit by reason of the insufficient size of the pipes. Some companies have reduced the leakage as low as 5 per cent. That is doing very well. Just think of what your profits would be if all of you could bring your loss down to only 5 per cent. Think how much less coal would cost you, and how much less labor would be required. I do not think there can be any more profitable field for investigation than that of leakage, especially to small companies, where the distance between consumers is great, and so are liable to a larger leakage on that account—perhaps this cannot be helped—but a good deal of it can be lessened with profit, and with pleasure, too.

Mr. Thomas—The case that Mr. McIlhenny instanced where a company sold more gas than it made is one that might be applied with force to some, if their figures are to be accepted. It was said of some companies in the olden times that when they sold only 10 per cent. more gas than they made they changed the superintendent. Of course a fair allowance should be made for shrinkage in both coal and water gas. I cannot say I have ever had any practical experience with water gas, but I think the shrinkage would be about one and the same in both. What ever difference there is is due to a difference in temperature when measuring the gas, and the temperature when the gas is sold. I know of cases where the unaccounted-for gas amounted to 40 per cent.—where they ran their gas out through a double-deck retort to swell it up, and the gas so made was at a very high temperature. If the gas was brought to about the proper temperature—say not over 65°—you will find but very little shrinkage in it. I know this from the fact that we put in a new holder that we hoped to use early in the winter season, but did not get it done until our heaviest consumption was over. We put 300,000 feet of gas in it which remained stored for six weeks; and although it varied every day according to the temperature, yet, taking the volume of gas and rating it with the temperature, there was about the same quantity in the end that there was at the beginning. This same experiment has been tried by another person, within the past six months. This was a case where the pipe conveying the gas ran under a river into the gasholder. The difference in volume made in this way closely approximated to 1 per cent. You will often notice that in cold weather your holders seem to contain less gas than they should hold, but when that gas is distributed the temperature is raised and the volume is brought back accordingly, so you will find very little difference. If you have a seemingly very small quantity, comparatively, in your holder on a cold day, still you are able to supply your consumers—as the temperature is raised by distribution the volume is increased. In addition to the 4 per cent. allowance for unaccounted-for gas, it was calculated there would be 4 or 5 per cent. of loss from the time the gas left the holder until it issued from the consumer's burner. I run gas for several years through over a hundred miles of pipes and yet our entire unaccounted-for gas did not exceed 6 per cent. The fact that many meters are running slow (some ceasing to register at all) will account for a good deal of unaccounted-for gas. I think if the gas is at the proper temperature when put in the holder and when distributed, the difference will be very small—provided the consumers' meters are all right.

Mr. Graeff—I have had frequent occasion to thank this Association for favors in the past, and I would like to thank it once again for demonstrating the fact that there is such a thing as leakage. I think it is a matter worth calling the attention of some gas men to, because, in my unfortunate census experience, I am finding a great many men who not only come up to what Mr. McIlhenny says they do in this country, but who actually do sell every foot of gas they make; that is they make so many feet of gas, and there are just as many feet sold. They not only do not have any leakage account, but it appears that they do not use any gas around their works. Every foot of gas made is sold. I would like it personally very much, if the average gas men could be instructed that as a matter of fact there is such a thing as leakage.

The Association adjourned to 2 P. M.

(To be continued.)

SPECIAL ENGLISH CORRESPONDENCE.

COMMUNICATED BY NORTON H. HUMPHRYS.

SALISBURY, March 10, 1891.

A Large Gasholder.—Gas Managers Associations.—Introduction of Machinery.—Incandescent Gas Lighting.

The South Metropolitan Gas Company are advertising for tenders for the construction of a gasholder that will, if completed, beat the record in point of size and storage capacity by a long way. I believe the largest gasholder yet constructed, which happens to belong to the enterprising Company just named—being situated at their Greenwich station—is about 256 feet in diameter by 180 feet high, and will contain over 8 million cubic feet of gas; but the new structure is to have six lifts, rising 30 feet each, and the diameter of the outer lift is to be 300 feet. This holder will contain some 12 million cubic feet of gas, and it is to be completed ready for use by Oct. 1, 1892. Mr. George Livesey took considerable interest in the discussions on gasholder guide framing, that occupied the columns of the *Journal of Gas Lighting* to a considerable extent some short time since, but I have not heard whether the new holder is to illustrate in practice any of the new ideas that have lately been put forth in the matter of dispensing with external guide framing, to the displacement of the time-honored columns and girders. It may be mentioned that one or two holders on Gadd's system, in which the structure is guided and supported entirely on the bottom curb, and also some on Pease's wire rope system, consisting of an ingenious arrangement of ropes, so connected that all are kept strained in every position of the holder, have been erected and in practical operation for some months. Sir Humphrey Davy, the leading chemist of the day when gas was first introduced, spoke sneeringly of the use of the dome of St. Paul's Cathedral as a gasholder. One can imagine the surprise of that eminent philosopher if he had been told of a gasholder that would not only take in the dome, but cover the whole breadth and half the length of the Cathedral, while equaling the whole building in cubical capacity.

The New England Association of Gas Engineers, in America, and the Manchester District Institution of Gas Engineers in England, have been celebrating their coming of age, respectively, within a few days of each other. In each case the circumstances are satisfactory, there having been a steady and healthy growth during childhood, and every prospect of entering upon a vigorous period of manhood. In referring to these facts one cannot help thinking of the progress in the gas industry during the last 21 years, and of the growth in ideas respecting the scientific, engineering, mechanical, financial, and commercial departments of gas supply that has been coincident with the development of these Associations. The "Manchester District," though not older than the Gas Institute, is the first of the District Associations in England. It represents a large amount of gas engineering talent gathered together within a comparatively small area, affording opportunity for frequent and fully at-

tended meetings that does not obtain elsewhere. The members take tea together in Manchester, and return to their respective homes the same evening. The geographical element, as influencing the facilities for reaching the place of meeting, must be of great importance to any Association of Gas Managers. But the advantage in this respect is only one amongst other factors that have served to make the Manchester District the foremost Association in England.

Another thought that these two celebrations brings forward, is their effect as pointing a wholesome lesson to those who as yet hold aloof from such Associations, or if they have joined them, only act as contributors of the annual dues towards the funds. With these examples before us it is useless to urge that gas managers' Associations are either unneeded or unimportant. I know a gentleman who has often said that he never went to these meetings because he knew his business as well as anyone else. He has since retired from active labor, and no special catastrophe has befallen the undertaking which he represented. In fact, it is doing better than ever it did before. The best and foremost undertakings in the country are under the care of those who take a prominent interest in our gas manager's Associations, who not only pay their guinea, but are always present at the meetings, and are frequent contributors of papers and participants in the discussions. The converse is also true. The undertakings that appear frequently before the public on account of bad gas, high prices, exorbitant profits, or other financial mismanagement, are just the ones whose directors are noted for the policy of keeping within their shells, and who would, if they could, stop their managers' salary for the time spent in attending an Association meeting. Let such persons follow the careers of the more prominent members, either of the "New England" or of the "Manchester District," and then say if such Associations are not something more than a mere social club, as some would have them to be.

A noticeable feature in English gas works is the rapid introduction of machinery for dealing with the transit of coal and other solid materials. This has obtained for several years in our largest works, in the form of steam cranes for lifting the coal from the vessels, or lines of rails with locomotives for transferring truck loads of material from one place to another. But I now refer more particularly to the introduction of devices for transferring the coal from the store to the retort, without the intervention of shovel or barrow; for taking the coke out of the retort into the coke yard; and for moving the materials in the purifying houses. And this not only at those generally known as large works, but at medium sized establishments making perhaps 100,000,000 to 200,000,000 per annum. Scarcely any extension is now carried out that does not embrace one or other of these modern improvements. One effect of this is that gas managers will have a greater draw on their knowledge of mechanical engineering in the future than they have experienced in the past. They will not only have to be good managers of men, but also good managers of machines. This is partly to be ascribed to the fact that the increasing size of gas undertakings, which gradually opens the door for the introduction of refinements that were formerly thought to be either unnecessary, or "not worth the candle;" but chiefly to the unsettled condition of stokers and various other classes of laborers engaged. The increased cost of coal, together with the objection that is naturally felt against increasing the price of gas, also tends to make directors more enterprising and willing to accept the recommendations of their engineers as to the introduction of any promising improvements. In easy times suggestions of this kind, if not actually dropped out of sight, may rest in abeyance for years.

The subject of incandescent gas lighting has been under the consideration of the Society of Chemical Industry, having been introduced by a paper read by Mr. W. Mackean, the Chemist of the Incandescent Gas Light Company, who gave a great deal of interesting information on the subject. The absolute steadiness, and high duty developed from the gas, have already led most gas engineers to believe that there is something in this form of lighting, which also offers the advantages of being to some extent independent of what we call the quality of the gas. A good incandescent burner, I need scarcely mention, would be a great step in the direction of a cheap fuel gas. In view of future probabilities, any authorative information on the subject is very welcome. Mr. Mackean was in a position to speak upon the results of extensive research into the effect of various ingredients, as used for the construction of the mantle, upon the color of the light produced, its illuminating value, and also the important question of durability. It is known that in this respect the incandescent gas light resembles the incandescent electric lamp. That not only does the mantle become worn out, so to speak, after a certain number of hours usage, but that from the time that it is first used, it begins to deteriorate in lighting effect, getting worse and worse until it is quite used out. How important this deterioration is, may be seen by the fact that in Mr. Mackean's best result a light that started at 23½ candles, went down to 16, or more than 30 per cent., after burning 1,000 hours. Against this it may be remarked that the duty afforded at the end of the period, which was over 6 candles per cubic foot of gas, was very good. But evidently the chief task that the makers of incandescent burners have to solve is to get a fairly regular duty, if only a moderately high one, throughout the life of the appliance. Certain rare metals, or rather their oxides, are used for the manufacture of the mantles, and already the various properties of each element seem to be fairly well understood. Mantles capable of affording either white, yellow, orange, or green colored light can be made, and a light of a slightly yellow tint appears to give the best result in a practical sense. As all students of the emission of light have observed, the color of the light exercises an important effect upon its diffusive or penetrating power, the color just named having the advantage in this respect. The gradual deterioration in respect to the illuminating power was said to be due to the loss (presumably by volatilization) of lanthanum, one of the rare metals employed in the construction of the mantle. So it appears that the secret of a lamp of regular power, would be the use of materials that are absolutely non-volatile under long continued heating. The importance of proper combustion, and of having the flame inside the mantle, was insisted upon. Mr. Mackean has been experimenting with magnesia combs on the Fahnehjelm system, but with only partial success, the chief drawback being the short duration of the comb. In the course of discussion Mr. Scudder stated that the original Fahnehjelm comb, as made in Germany, only gave a duty of 3½ candles per cubic foot of gas used; but he had seen some that were made in America, and gave as much as five candles. He found that the cause of this was due to the fact that the comb, after completion, was dipped in a solution of chromate of potash and then allowed to dry. This treatment also had the effect of rendering the light yellow.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE Greenpoint (L. I.) Chemical Works have taken over the business of the Hill Chemical Company, and will hereafter fill orders for their specialty—iron mass for gas purification. Mr. John Schriever remains Manager of the business. The office and works of the Company are located at Greenpoint avenue and Newtown creek, on the Northeast boundary line of Brooklyn city.

THE Elgin (Ills.) American Gas Company has been granted a renewal of its franchise, to cover a period of 20 years. This favorable action determined the question whether the proposed expenditures on plant shall be made at once, and now we presume that Manager Fitz will have a word or two with gas works contractors. Something like $20,000 will be expended, a large part of which will go into new 6 inch wrought iron mains. The City Council was unanimous in its action on extending the ordinance which speaks well for Mr. Fitz's popularity, who, although he has been in charge at Elgin only since February, 1890, has managed to cut gas rates about 12 per cent. The home company, too, ought to be well satisfied with his efforts on their behalf, as the sendout has been augmented largely by his well directed policy.

SPEAKING of the American Gas Company prompts us to state that General Manager Ramsdell is not identified in any way with the proprietorship of the Ramsdell patents or process for the manufacture of wood gas.

A CORRESPONDENT forwards the following particulars respecting the plant of the Equity Gas Company, of Brooklyn, N. Y.: "The proprietors of the Equity Gas Company, which has the right to supply gas in what is known as the Eastern District, Brooklyn, having demonstrated through the courts the legality of their charter (issued in 1874), have authorized the Equity Gas Works Construction Company to erect their plant, etc., the details of construction to be under the direction of Mr. W. P. Elliott. Some months ago a tract of meadowland, close by Newtown Creek, was purchased, the whole embracing 74 lots, each 125 feet by 25 feet. The property is divided by Maspeth avenue, and runs from Vandervoort to and a trifle beyond Porter avenue. The main building, which will face Maspeth avenue on the south side, will have a frontage of 210 feet, with an L on Porter avenue of 155 feet. The Maspeth avenue front will be flanked by tower gables, 30 feet square, and the buildings will be of brick, trimmed with granite. The roofs are to be of iron, and the floors of concrete. The contracts for the piling (over 4,500 piles will have to be driven), mason work, apparatus, etc., have been let out. The offices of engineer and superintendent (22 by 40 feet) will be in the

tower on Vandevoort avenue, next to which, on Maspeth avenue, comes the purifying house, 112 by 39 feet. Then comes the lime house, 18 by 42½ feet. On the eastern boundary line of main building (corner of Porter avenue) is located the scrubbing and condensing room, 22 by 42½ feet. Directly in line with the latter is the generating house, 66 by 42½ feet, followed by the boiler and engine house, 32 by 42½ feet. All the machinery will be duplicated, and elevators and labor-saving appliances will be availed of wherever possible. It is calculated that the works are to have a per diem capacity of 1,800,000 cubic feet, and a high candle power (25) water gas will be distributed. The 24-inch leading main will run from the holders (these will likely be two in number) to Humboldt street, leading there into three trunk lines (20 inches in diameter), one of which will run from Humboldt street to Bushwick, on to Fairfax street; the second will lead to Union avenue to Broadway, to Fairfax street; the third to Box street, tapping the Greenpoint district. The lateral mains will run from 10 to 4 inches in diameter, and the plotting calls for 108 miles of mains. The proprietors will push the work vigorously, and Mr. Fanshawe will give it close personal attention."

MR. WILLIAM L. FREEMAN, well known in Freehold, N. J., from his long connection with the local gas company, has engaged there in the plumbing business.

LAST week mention was made in the JOURNAL of a discussion over the supposed low candle power of Philadelphia gas, wherefore a certain Mr. Brooke, of that city, paid over to a Pennsylvania charitable institution a sum of money—Mr. Brooke insisted that the candle power was lower now than it had been for 20 years, while his opponent held to the contrary. The official figures respecting the average candle power of the gas for the past 20 years are accordingly appended:

Year.	Candle Power.	Year.	Candle Power.
1871	14.95	1881	16.31
1872	16.36	1882	16.39
1873	16.28	1883	17.16
1874	16.38	1884	17.20
1875	16.61	1885	17.35
1876	16.93	1886	17.29
1877	16.39	1887	17.65
1878	16.19	1888	18.54
1879	16.24	1889	20.07
1880	16.26	1890	19.73

CHRIS. BONN, Chairman of the Lighting Committe, of Burlington, Iowa, has been authorized to obtain tenders for the public lighting of that city. The specifications call for arc lights of 2,000-candle power, and gas lights to be not less than 20-candle power. The bids are to be based on contract terms of 1, 3 and 5 years.

SUPERINTENDENT W. A. ROSS, of the Kenton (Ohio) Gas and Electric Light Company, is a firm believer in the gas end of the business, which is the main dividend reliance on the part of the proprietors.

THE authorities of Marblehead, Mass., will petition the Legislature for the right to operate an electric lighting plant on public account.

THE Ohio Legislature has indorsed the Taylor bill, which makes it a misdemeanor for any "unauthorized person" to tamper with the pipes or fixtures of artificial or natural gas companies.

THOSE interested in the proposed amalgamation of the Kingston (N.Y.) Gas and Electric Light Companies, which was interrupted some time ago by injunction proceedings, have applied to the Legislature for relief. There is no doubt that the appeal will be successful.

UNDER the agreement between the City Council and the Orlando (Fla.) Gas Company, the authorities are to pay $22 per annum for each lamp maintained—moon table—the Company binding itself to put in lamps in any street not now served by its mains, provided 5 lamps are to be maintained over each 1,500 feet of pipe laid.

AT the annual meeting of the Middletown (Conn.) Gas Company the following officers were re-elected: President, A. B. Calef; Secretary and Treasurer, Frederick E. Camp; Superintendent, John H. Jones.

A CHICAGO correspondent, writing under date of March 19, says: "The charter of the Elgin (Ills.) American Gas Company, will expire by limitation on August 2, 1891. It was granted to Amasa Swift and associates, in 1871, and was meant to be quite a privilege, in that it gave to them 'the exclusive right of using the streets, alleys, lanes, etc., * * * for the purpose of laying pipe for the conveyance of gas etc.' It is also interesting to read in the long ordinance granting this franchise that 'in consideration of the privileges granted to the Company they shall furnish to the citizens of the said city gas at the rate of $4.50 per 1,000 cubic feet, until the number of consumers shall reach 150, when the price shall be reduced to $4, and so remain for a term of 5 years.' After that date the price was to be as low as in any Illinois city, except Chicago, within 25 miles of which coal is not mined, for a like quality of coal gas. The new franchise (adopted a few days ago) is a short and modest one. It provides, 'that the privileges granted to the Elgin Gas Light Company be and are hereby extended and continued to the Elgin American Gas Company for a period of 20 years, and it is guaranteed that upon the expiration of the privileges hereby continued the Company or its assigns shall have equal rights and privileges with any other gas company which may be formed for the purpose of supplying said city with gas, provided the privileges hereby granted shall not be taken as exclusive; and provided further, that the rate charged for gas by the said Company shall at no time exceed $1.50, net, per 1,000 feet on all bills paid before the 10th of the month.' Chicago and Elgin parties built the works originally, and they lost a lot of money. Finally, the works were taken by Eastern capitalists who eventually managed to make them self-supporting. They, in turn, sold the plant to the American Company; and now the works are to be remodeled, if not rebuilt.—S."

J. A. PENNEBECKER and wife are suing the Ashland (Wis.) Lighting Company for $25,000, because of injuries sustained by them in a recent gas explosion. They allege that the Company neglected to keep its pipes in repair.

MILWAUKEE, Wis., is noted for two things—its beer, and the fact that so far only one Gas Company has been granted a charter to do business in the city. The German contingent—and other contingents as well—take kindly to the beer, but they seem to be opposed to permitting one Gas Company to retain the field. Possibly, they argue that as the flood of beer has increased with the duplication of the breweries, the flow of gas ought to be more pronounced by the chartering of additional gas companies. Whether or not this is a fair view to take of the situation, it is nevertheless a fact that the German residents of the Second and Ninth Wards are very enthusiastic over the proposition to charter a fuel gas company, of the Hyde Park (Chicago) stripe, and they have "hired halls" for the purpose of giving expression to their feelings in an outspoken manner. The first gathering was held in the Second Ward—the Ninth Ward assemblage we have not yet heard from—and a correspondent forwards the following account of the discussion that was held thereat: "Fifty residents of the Second Ward, and about 10 residents of other wards, met recently in the basement of the Liederkranz Hall to consider the fuel gas question. The meeting was organized by electing Gustav Kaiser, Chairman, and Henry Thiele, Secretary. The Chairman said that the meeting had been called to express disapproval of the action of the Aldermen who had voted against the fuel gas ordinance. He took it for granted that the fuel gas it was proposed to introduce in the city was cheaper than coal, and that the new Company was backed by reliable capitalists. Having finished his speech, the Chairman sat down, whereupon an awkward silence fell upon the assembled burghers. At last a man named Gottschalk took the floor. He said that as the Council would shortly meet to take final action on the fuel gas ordinance, and that as the old Company seemed to be in control of a great many aldermanic votes, if positive action were not taken the old Company might succeed in 'knocking out' its youthful rival. He, therefore, moved the appointment of a committee of three to draft suitable resolutions for speedy presentation to the Alderman of the Second ward. The motion was opposed by Charles Forster, who counseled waiting until the return of the Council Committee from its investigation trip. No one in the meeting, he said, knew anything about water gas, nor could anybody tell whether the new Company would not result in another monopoly, or was not aiming to be bought out by the old Company. He did not wish to condemn the city representatives without a hearing. Mr. Gottschalk replied that the Committee now engaged in investigating gas could not be relied on, as four out of its five members were in favor of the old Company. Chairman Kaiser, from a circular, started out to praise the advantages of the fuel gas, and brought out as a 'strong illustration' the fact that the Council would not have taken cognizance of the protests of one saloonkeeper against issuing a license to another saloonkeeper next door to him. A beardless youth then expatiated upon the rights to which citizens are entitled, and a motion to adopt the Gottschalk motion was put and carried. Chairman Kaiser named Messrs. Gottschalk, Hammond and Forster as the Committee, but Mr. Forster declined to act. He suggested that the Committee be instructed to re-

port immediately after the presentation of the report of the Council Investigating Committee. Leo Hammond sided with Mr. Forster. The Committee of Council, he said, were honorable men, and it would look like presumption for anyone to undertake to censure the Alderman for acts which they have not yet performed. Perhaps the new Company was merely an imposition, or a scheme to squeeze money out of the old Company. Perhaps the new gas was of no use, which he, personally by-the-way, knew to be a fact. A water gas plant had been established at Appleton, Wis., but it was a complete failure. Robert Schilling was called upon for a speech, and that worthy who never loses an opportunity to pose as a know-all, 'went at the matter before the house' in his usual impetuous, noisy manner. He urged those present to join in a general movement in favor of the city establishing its own works. The new Company would ultimately branch out into another monopoly, and the people would have 'to fight two dogs;' whereas if the city took hold of the gas business the price of gas per 1,000 would be 10 cents, and millions would annually be saved to the citizens of Milwaukee. He styled the old Milwaukee Gas Light Company an 'infernal, robbing monopoly,' which was defrauding the citizens. He referred sarcastically to Superintendent Cowdery accompanying the Investigating Committee on their trip, and indulged in much more that was ridiculous. Finally, the meeting adjourned, the Committee receiving instructions to report at the call of the Chair."

JAMES B. QUINN, General Manager of the United States Gas Consumers' Protective Association, of Chicago, Ills., was in Milwaukee a week or so ago, testing the meters of gas consumers, on account of or at the request of the latter.

THE practice of the Zanesville (O.) Gas Company is to replace worn out gas burners with new ones without charge to the consumer. Gas stoves are also placed on trial for a reasonable period without charge.

FROM a recent letter issued by the proprietors of the Westinghouse Machine Company we make the following extracts: "For several months past the daily press has constantly referred to what is called the financial troubles of the Westinghouse interests. While it is true that there are several industrial corporations which in one form or another bear the name of Westinghouse, it is equally true that the financial troubles among these companies have been confined to what is known as the Westinghouse Electric and Manufacturing Company: or, in other words, to that Company whose business consists in making and vending electrical apparatus. The Westinghouse Machine Company, for instance, whose business consists in making and selling, through the medium of its agents the world over, its well-known Westinghouse engines has had no financial trouble, and, to use a current expression, 'is not in it.' Instead of curtailing its operations, this old, reliable institution is still further increasing its capacity as rapidly and as much as it can. New tool and storerooms are just approaching completion, and it is hoped by the management, during this spring or summer, to be able to add complete new erecting and testing shops, fitted with large power cranes and all modern improvements, and which shops will have a producing capacity twice as great as the present ones."

A PETITION has been made for the appointment of a receiver for the Iowa City (Ia.) Gas Company.

THE Port Huron (Mich.) Gas Company will enlarge its plant. The Company is gaining ground rapidly.

A PROMINENT candidate for the Directorship of the Philadelphia Public Works Department is William D. Gardner, an ex-President of the old Gas Trust.

FROM the annual report of Mr. C. W. Hinman, the Massachusetts gas and gas meter inspector, the following interesting matter is gleaned: In the twelvemonth 18,205 meters were inspected, of which 17,984 were either new or recently repaired meters, which large number was chiefly due to the action of the Boston Company in repairing a high percentage of its meters in service. On the complaint of either the consumers or companies 221 meters were tested. Of these 64 were fast, with an average error of 5.32 per cent.; 134 were within the legal limits—2 per cent. either way; 20 were slow, with an average error of 23.60 per cent.; and 3 did not register at all. The average error of all was .60 per cent. slow—making no note, however, in the average of the meters that failed to register at all. The general average last year (218 were tested) was .05 per cent. slow. The Inspector calls attention to the fact that of the meters brought to the office under suspicion in late years about 60 per cent. are correct. Of the incorrect meters, 70 per cent. are fast and 30 per cent. are slow, but the slow meters on the average are more than twice as much in error as the fast meters. Having noted the conditions under which consumers may have their meters tested by the State, and calling attention to the imperfect method usually followed by itinerant meter inspectors, as well as to the overcharges made for inspections by such persons, the Inspector passes on to the matter of testing for candle power and purity. He introduces these topics by mentioning the apparatus employed and the method of testing followed. During the year, 436 separate inspections were taken at works where coal gas or a mixture of coal and water gas was made, Boston having been visited 52 times; Lowell, 35; Roxbury, 26; Worcester, 20; Cambridge, 20; Springfield, 12; and so on. The grand average candle power was shown to be 17.83. The average content of sulphur, in grains per 100 cubic feet, is returned at 10.13, and the ammonia content is reported at (average) 10.13 grs. Of the oil gas companies 18 inspections were made, Stoughton gas showing the highest (52.80), candle power, that at Southbridge being 23 candles. The average for all inspections made of the oil companies was 39.04. The candle power of the companies over the State shows an increase over the previous year. The Inspector finds that the companies sending out a mixed gas (coal and water), in which coal gas forms the larger portion of the mixture, are subject to great fluctuations in candle power, the difference between the highest and lowest values averaging 3½ candles. Several companies were delinquent in respect to excess of impurities—sulphur, sulphureted hydrogen, and ammonia—over the statute provisions, but the reason given is the inferior nature of the coals that many of the companies were obliged to carbonize because of the labor troubles at the mines in the standard gas coal regions. The Inspector concludes his report by submitting no less than 20 eudiometric analyses of mixed gases distributed at 13 different points in the State (the duplicates are from Dorchester, Boston, Fall River and Cottage City), but as these are of sufficient value and importance to be given in full, they will be so reprinted in a future issue; as also will be his remarks or comments in the matter of the good policy of changing the statute regulations regarding the test burner for estimating the lighting value of Massachusetts gas. Taken all-in-all, the document is a very interesting one, and the clearness and precision with which its matter is set forth are new evidences of the careful methods that actuate Mr. Hinman in carrying on the duties of his place and office.

THE premises and plant of the Hamilton (Ont.) Electric Light Company are to be sold at auction, without reserve, on April 15th. The sale is ordered by the Canada Permanent Loan and Savings Company, which holds mortages on the plant in the sum of $148,000.

THE Kingston (Canada) Gas Light Company will increase its capital stock to $250,000, in order to provide for payments necessitated by its recent absorption of the Kingston Electric Light Company.

THE Tennessee Legislature has passed the bill under which Pulaski asked for powers to purchase and operate an electric light or gas plant.

THE number of gas consumers in Philadelphia is 134,555, who maintain 2,328,986 separate gas burners. The public gas lamps, number 18,984. The authorities complain that "the increase in the quantity of gas used by the several city departments, and for which neither credit nor money passes to the Bureau of Gas, continues with unabated rapidity, and now amounts to as much as the total private consumption of 1864. The number of broken lamps reaches such startling figures that more stringent measures should be adopted by the proper authorities to make the breaking of a lamp too expensive for every day indulgence. The total number of lamps under the care of the Bureau of Lighting, so far as repairs are concerned, is 18,984, and the report of the Chief of the Bureau shows that 42,453 broken glasses were replaced, more than 2¼ breakages to each lamp. The sum paid for electric arc lights last year was $201,259.29, nearly two-fifths of the total expenditure for lighting. These figures are growing so rapidly, that the question of the establishment by the city of electric lighting stations is becoming one of pressing moment. In the previous reports from this department this question was fully argued, and nothing has occurred during the past year to change the conclusions then expressed. The city should do the work of electric lighting, without the intervention of private corporations. The public highways, under and above ground, are granted to these companies, enabling them to compete with the city in furnishing gas to the general public, to the immediate loss to the City Treasury. To aid them in doing this the city then pays them over $200,000—surely bad financial management, benefiting no one except the stockholders of these companies."

THE AMERICAN
GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

EDITOR—Jos. R. Thomas, C.E.
ASST. EDITOR—T. J. Cunningham.
MANAGER—C. E. Sanderson.

PUBLISHED ON EACH MONDAY OF THE YEAR AT
No. 42 Pine Street, New York.

This is a recognized official organ of
LIGHT, HEAT, STEAM, WATER SUPPLY,
VENTILATION, SANITARY IMPROVEMENT,
AND GENERAL SCIENCE

TERMS:

SUBSCRIPTION—Three Dollars per annum, in advance. Single copies, 10 cents.

AGENTS.

NEW YORK.—AMERICAN NEWS CO., 39 and 41 Chambers Street.
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MONDAY, MARCH 30, 1891.

Gas Stocks.

Quotations by Geo. W. Close, Broker and Dealer in Gas Stocks,

16 WALL ST., NEW YORK CITY.

MARCH 30.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share.

	Capital.	Par.	Bid	Asked
Consolidated	$35,430,000	100	95½	97
Central	500,000	50	90	100
" Scrip	220,000	—	95	100
Equitable	4,000,000	100	116	118
" Bonds	1,000,000	—	113	115
Harlem, Bonds	170,000	—	—	—
Metropolitan, Bonds	658,000	—	110	115
Mutual	3,500,000	100	119	120
" Bonds	1,500,000	—	100	102
Municipal, Bonds	750,000		—	—
Northern		50	—	—
" Bonds	150,000	—	—	100
Standard Gas Co—				
Common Stock	5,000,000	100	—	48
Preferred	5,000,000	100	—	90
Yonkers		50	112	—
Richmond Co., S. I.	346,000	50	—	—
" Bonds	20,000	—	—	—
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	117	120
Citizens	1,200,000	20	88	91
" S. F. Bonds	320,000	1000	100	103
Fulton Municipal	3,000,000	100	130	132
" Bonds	300,000		100	105
Peoples	1,000,000	10	88	90
" Bonds (7's)	368,000	—	100	—
" " (6's)	94,000	—	100	—
Metropolitan	870,000	100	100	105
" Bonds (5's)	70,000	—	—	—
Nassau	1,000,000	25	134	—
" Ctfs	700,000	1000	100	103
Williamsburgh	1,000,000	50	130	—
" Bonds	1,000,000	—	108	112
Out of Town Gas Companies.				
Boston United Gas Co.—				
1st Series S.F. Trust	7,000,000	1000	—	87½
2d " " "	3,000,000	1000	74½	76
Bay State Gas Co.—				
Stock	5,000,000	50	54½	55
Income Bonds	2,000,000	1000	95½	—
Buffalo Mutual, N. Y.	750,000	100	105	110
" Bonds	200,000	1000	95	100
Citizens, Newark	1,000,000	50	155	160
" " Bonds	45,000	—	—	—
Chicago Gas Company	25,000,000	100	43½	44¼
Chicago Gas Light & Coke Co.—				
G't'd Gold Bonds	7,650,000	100	84¾	85½
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1000	—	98
People's Gas and Coke Co., Chicago—				
1st Mortgage	2,100,000	1000	—	100
2d "	2,500,000	1000	94	98½
Consumers Gas Light Co., Jersey City	2,000,000	100	12	15
Bonds	600,000	1000	70	75
Cincinnati G. & C. Co.	6,500,000	100	204	205
Consumers Toronto	1,000,000	50	190	200
Central, S. F., Cal			92	100
Capital, Sacramento, Cal			58	
Consolidated, Balt	11,000,000	100	47¼	48
" Bonds	6,400,000		107	107½
Citizens Gas Lt. Co., Rochester, N. Y.	500,000	—	85	110
Bonds	250,000		—	—
East River Gas Co., Long Island City	1,000,000	100	100	105
Bonds	500,000	100	100	102
Hartford, Conn	750,000	25	102	108
Jersey City	750,000	20	165	170
Louisville, Ky	2,570,000	50	125	130
Little Falls, N. Y.	50,000	100	—	100
" Bonds	25,000	—	100	103
Laclede Gas Light Co., St. Louis, Mo.—				
Common Stock	7,500,000	100	15½	16½
Preferred "	2,500,000	100	46	51
Bonds	9,034,400	1000	77¾	78
Montreal, Canada	2,000,000	100	200	208
Memphis (Tenn.) Gas	750,000	100	40	—
" Bonds	240,000	100	103	—
New Haven, Conn		25	200	—
Oakland, Cal			34¼	35½
Peoples, Jersey City		—	60	61
" " Bonds			—	—
Paterson, N. J		25	99	102

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Has had 12 years' experience in all parts of the business, from retort house to consumer, including bench setting; has been Foreman and Asst. Superintendent for six years. Best of references. Address
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This gas can be furnished at a cost less per 1,000 cubic feet than the coal gas may be costing the company.

Our system is such that we can furnish plants that will carburet 50,000 cubic feet in 24 hours, or three or four million feet in the same length of time. *One* of our large benches or plants would be capable of generating 100,000 cubic feet of gas in 24 hours, which would raise the candle power on 2,000,000 feet (taking as a standard coal gas at 15 candles) 3 candles on the 2,000,000 feet, enabling the works to deliver to consumers an 18 candle gas; or, enlarging our plant, the candle power may be increased as desired, at the same cost per candle power, less interest on plant.

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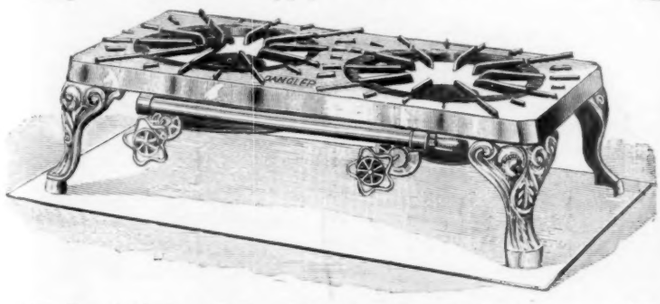

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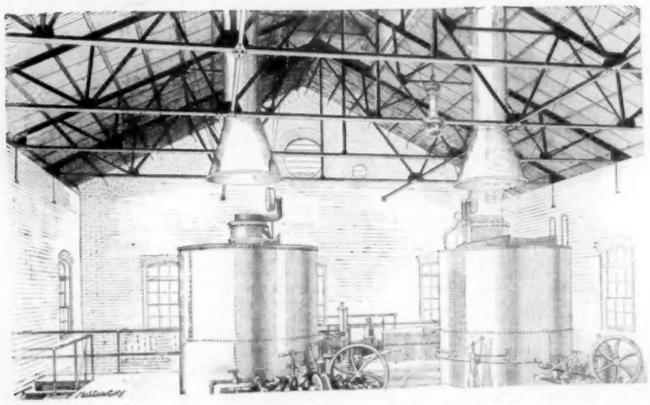

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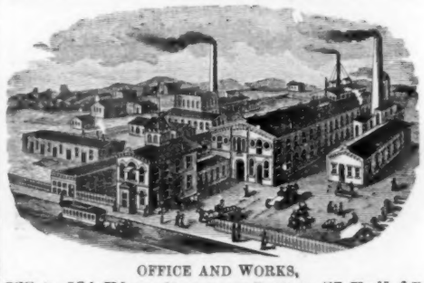

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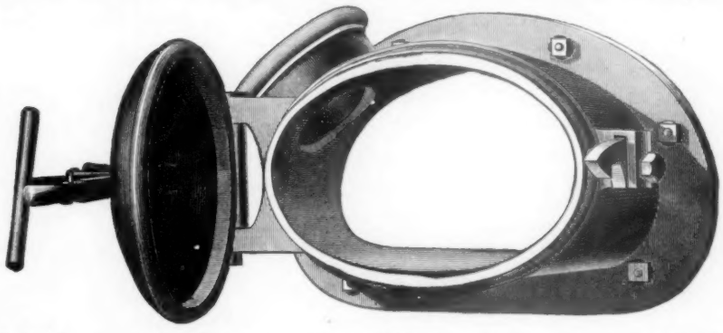

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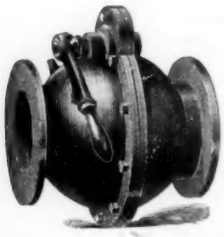

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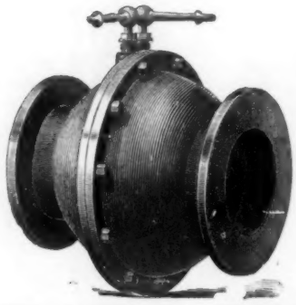

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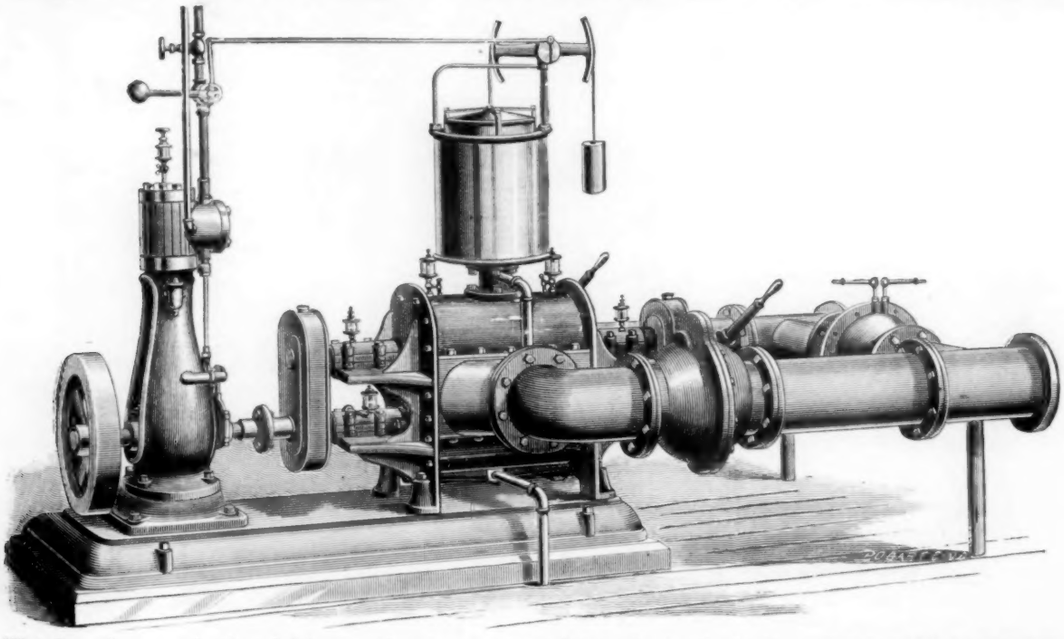

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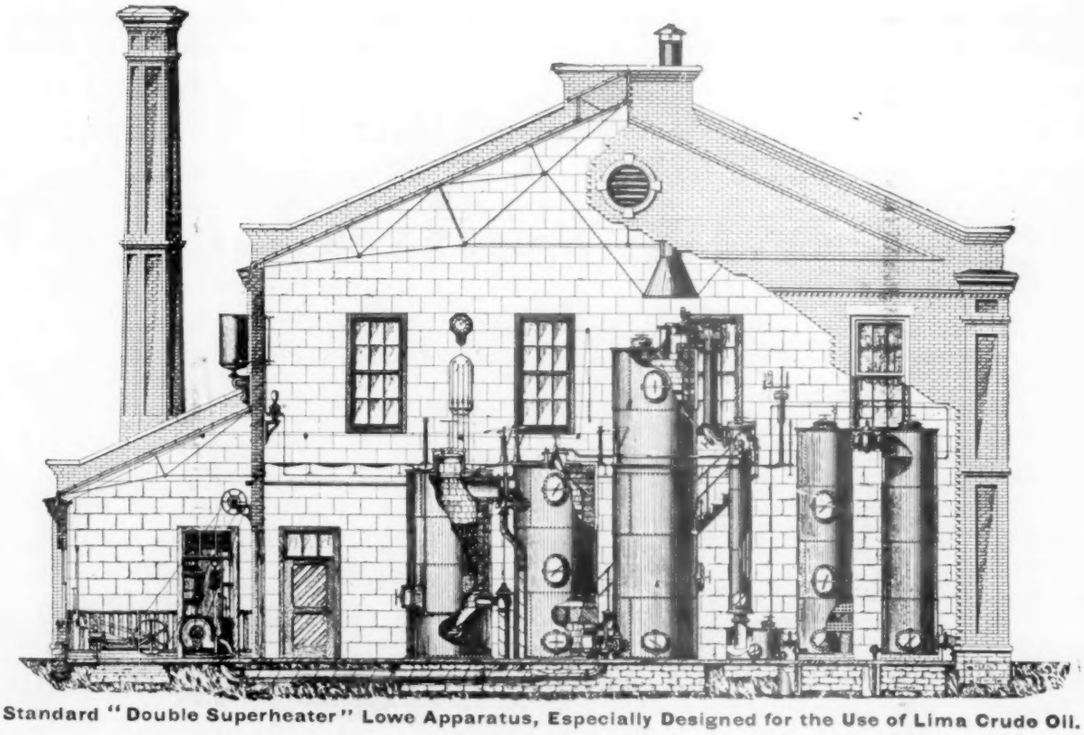

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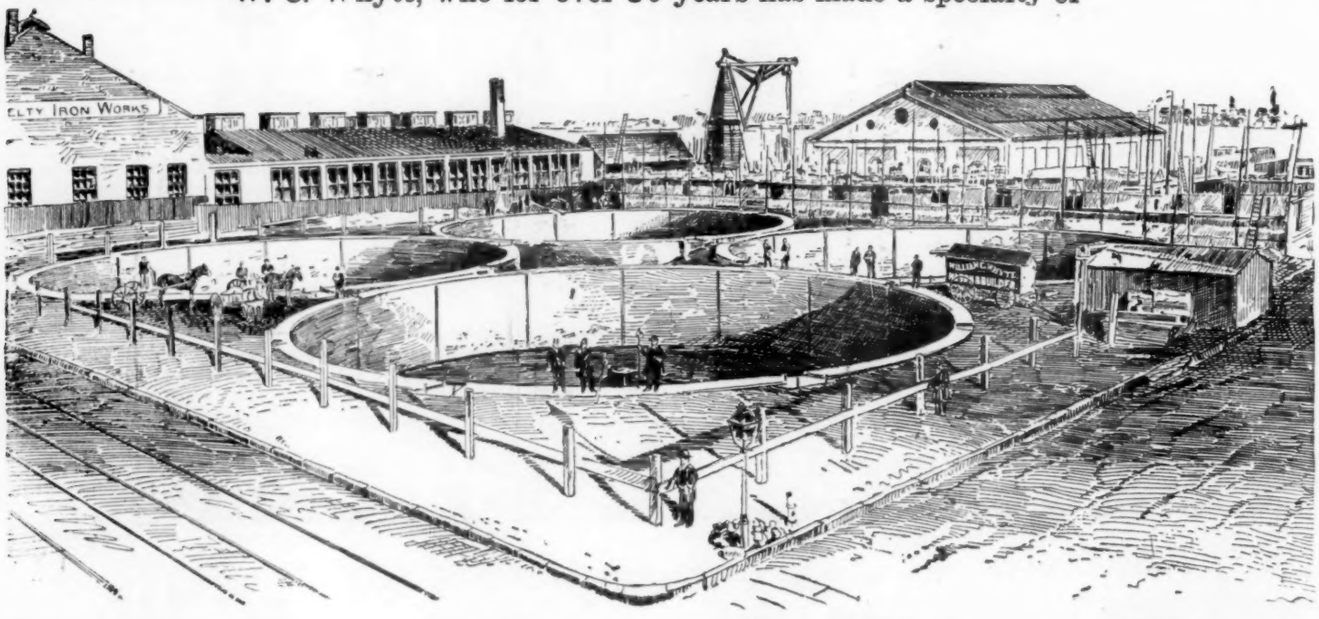

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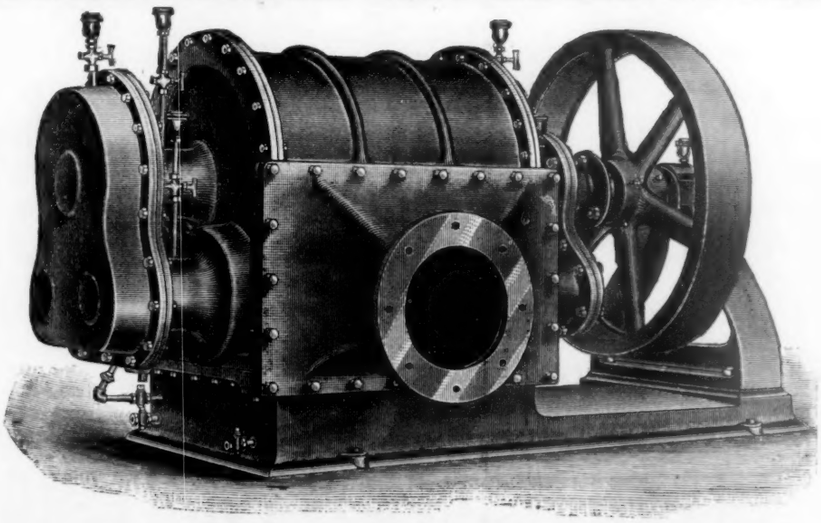

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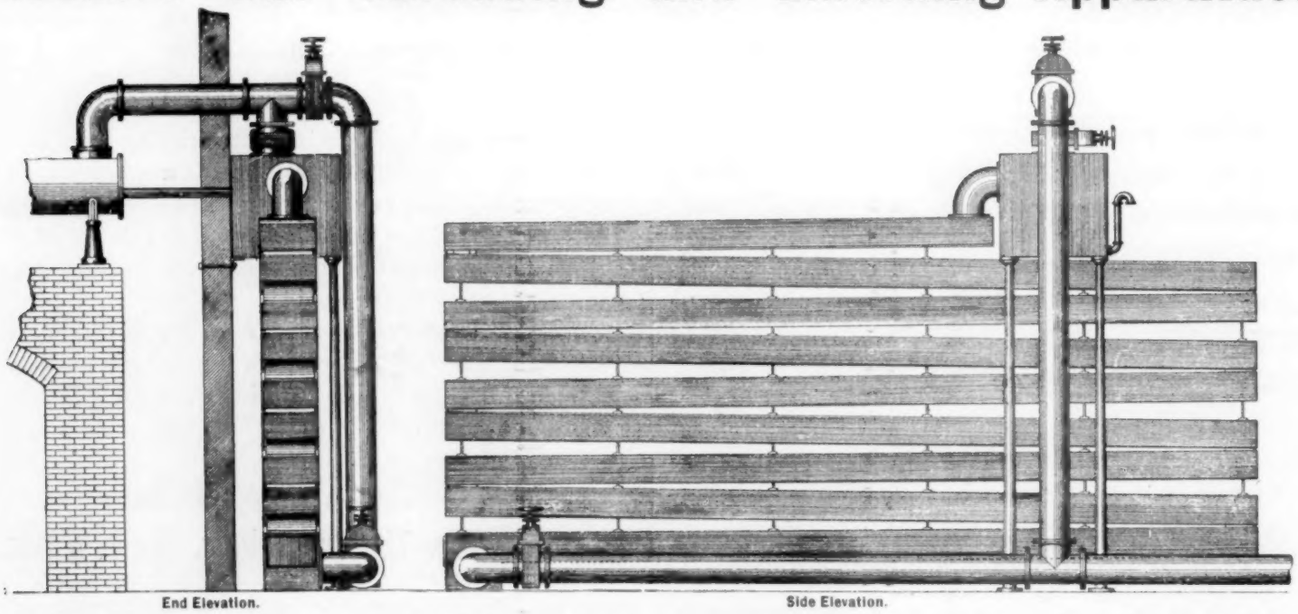

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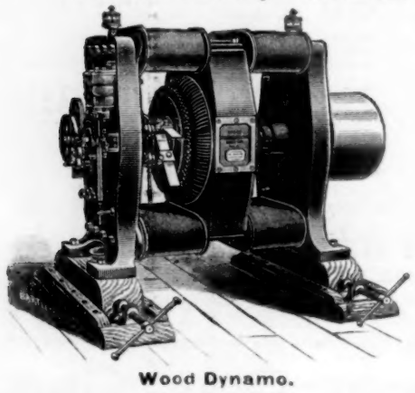

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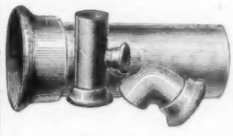

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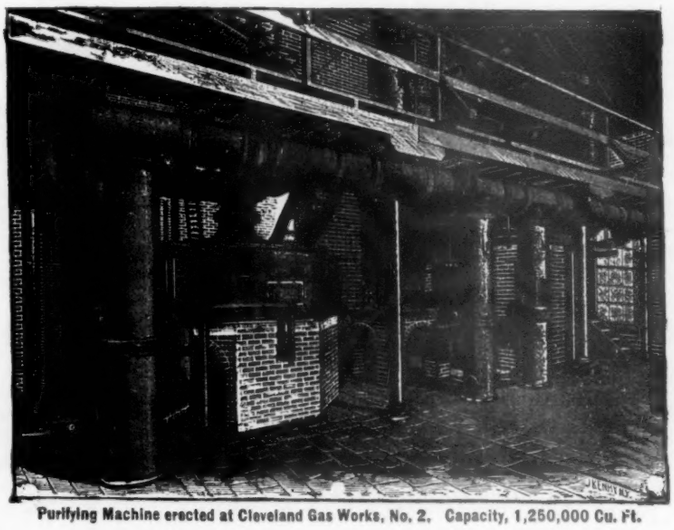

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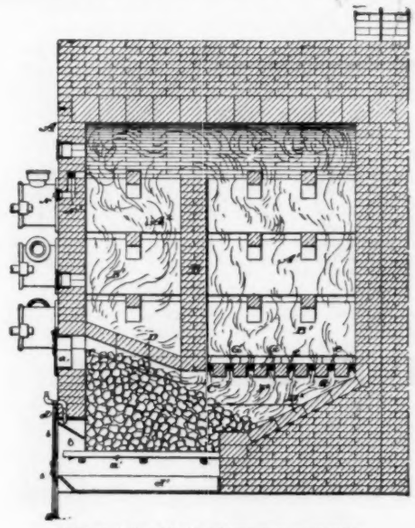

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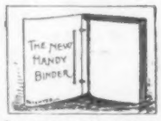

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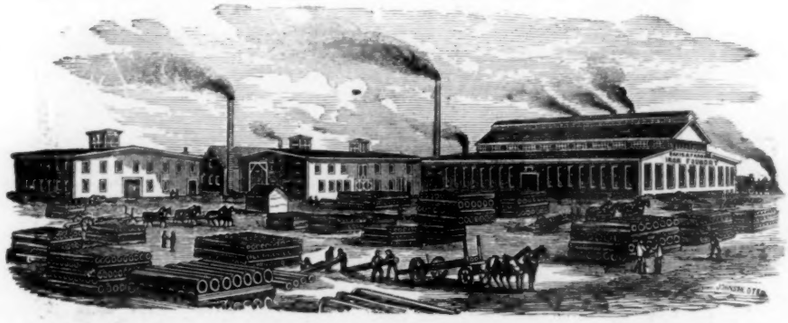

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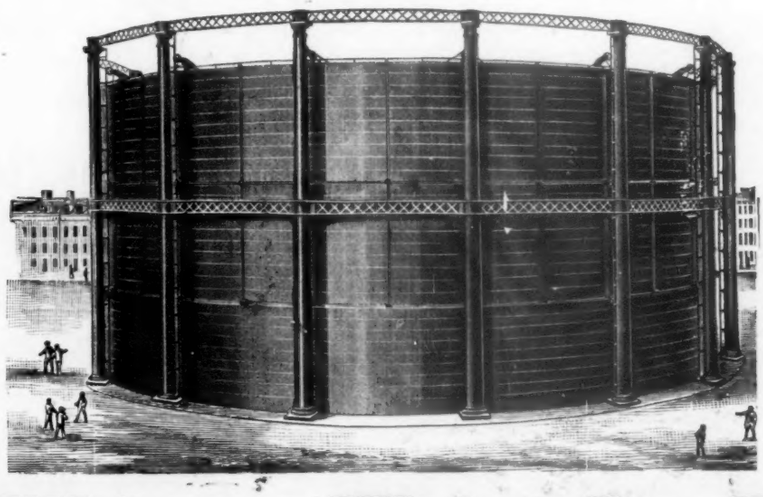

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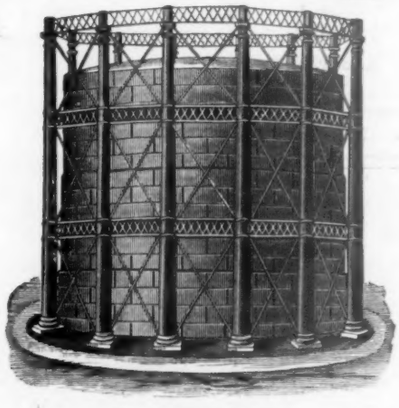

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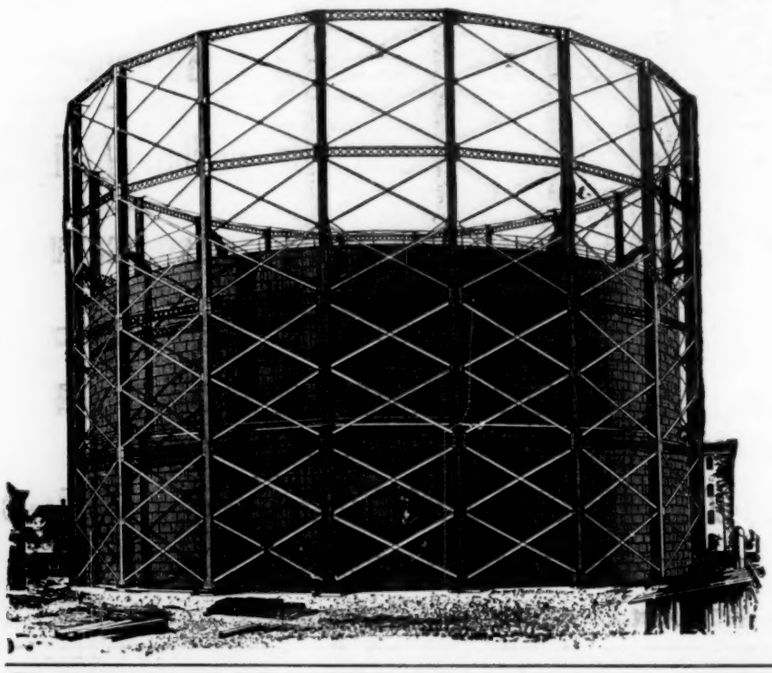

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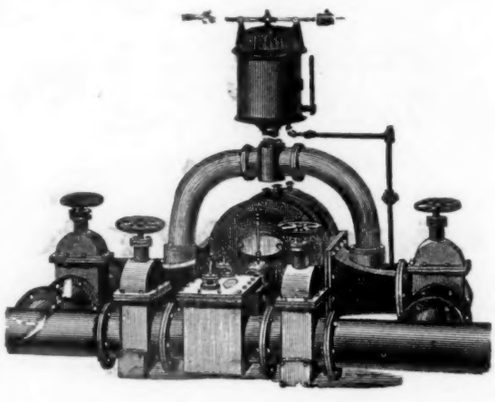

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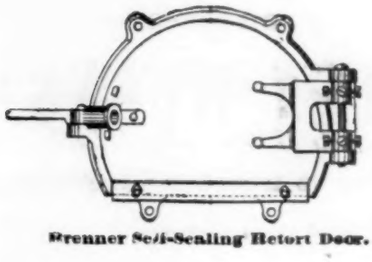

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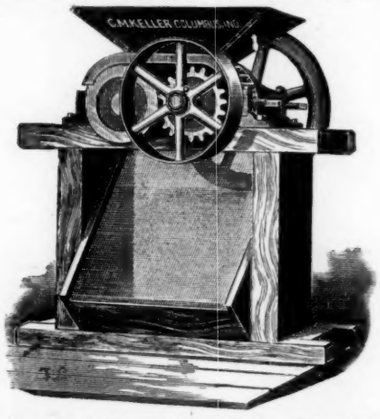

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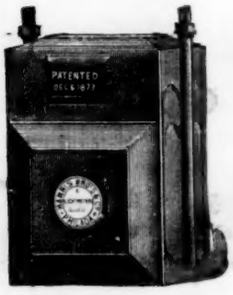

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37 in. high.	12 in. high.	12 in. high.	24 in. long.	36 in.
20 in. wide.	17½ in. wide.	18 in. wide.	21 in. wide.	
	12 in. deep.	13 in. deep.		

This Stove has four burners on top, and double oven burner.

Consumption of gas with all burners in use, 42 feet per hour, at 1 inch pressure.

The top is made in sections, so that a greater variety of cooking utensils may be used. By lifting out the covers and crosspieces and putting in a suitable forked ring, which is sent with each stove, a wash boiler or other large utensil may be set over two burners. Our **No. 87 GRIDDLE** also fits in the same position. The roasting oven is provided with a cast-iron door.

All Fittings are Nickel-Plated.

GAS COOKING STOVE, No. 7 B.

SIZE.

Stove.	Oven.	Roaster.	Top.	Length over Extension Shelves.
31 in. high.	9½ in. high.	10 in. high.	21 in. long.	32 in.
17 in. wide.	14½ in. wide.	15 in. wide.	16 in. wide.	
	12 in. deep.	13 in. deep		

This Stove has three boiling burners in the Top or Hot Plate, and one single oven burner.

This cut represents our New Style Cooking Stove. As will be seen, it has an ornamented cast-iron Base and Front, and extension shelves. The Oven Burner, which is atmospheric (unless otherwise ordered), is of an entirely new and improved pattern (patent). The ovens are of greater capacity than those of the old style. The Top, in conjunction with the Outlet Pipe, is designed to carry off all the products of combustion, if desired, but they are also supplied with a loose ring which converts it into an ordinary open top stove.

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BRIEFLY TOLD.

GAS WORKS RESIDUALS.—A very interesting paper at the Ohio meeting was that read by Mr. George Osius, of Detroit, Mich., who most acceptably placed before the convention a series of arguments as to why a small works would find it profitable to utilize its ammoniacal liquor. The author surely did not leave himself open to the charge that the title of the paper was misleading, since he applied his "suggestions to works of from 750 tons of coal carbonized annually," and from that on in the ascending scale. That quantity comes down to about two tons of coal burned off each 24 hours, hence the plants considered are small, but nevertheless are large enough, in the belief of their proprietors, to warrant the conclusion that the penny saved in their working is equally as weighty as the penny saved in those plants that count their tons carbonized up in the thousands. The only difference in the two instances is the number of pennies accumulated by the force of conditions. In these days of competition he who neglects to avail himself of all the forces at his command must not complain when the swifter tread of the economist puts the latter far in the lead. And so we say again that Mr. Osius is to be commended for his well-put-together reminder that almost the smallest gas works manufacturing coal gas can handle its ammoniacal liquor product with profit and ease, and inexpensively, compared with the return had on the money invested in the necessary additional apparatus, and on the slight additional labor involved. Mr. Osius puts the way in which the desired end can be accomplished so clearly that we are not justified in singling out one or many of his suggestions in this regard for comment; suffice it to say in general that his methods, being simple and rational, must be successful. The discussion on the paper was brisk and useful, in that it was pointed and elicited an account of the practice of others who, in larger works, have been successful in recovering and selling to advantage what had once been with them, too, a waste product. Mr. Harbison, for instance, admitted that the drains from the Hartford plant at one time were pouring a wealth of disinfectant into the stream that flows by his works, but time and advance have corrected his Company's efforts in that respect on behalf of the public good. The Hartford Company now reaps profit, and substantial profit, out of that which it considered a nuisance in the past—an opinion also held by other residents on that stream, who were wont to turn their noses up at the material evidence afforded them of the Gas Company's attempts at practical disinfection. Further along in the discussion we have Mr. Humphreys' evidence that his practice in working up the gas liquor at Lawrence, Mass., has resulted in taking away from visiting drummers all the usefulness of the latter as sellers of aqua ammonia on wholesale account. The Lawrence Company has the field all to itself. The Humphreys practice, of course, is perhaps more elaborate than many would care to engage in, and that the smaller works would not find it profitable to do so is quite likely; but the instance is patent evidence respecting the value of saving the liquor, for sale to workers-up of the product. We also note that in the discussion instances are given (at Altoona, Pa., 20 cents, and at Columbus, O., 25 cents) of rates at present obtained for 10-oz. liquor, and while these are noteworthy it might be here said that as long ago as 1883 one of the Brooklyn Companies contracted for its gas liquor at the rate of 27½ cents per ton of coal carbonized—the average strength being 10-oz. We think this paper

and the discussion will put many a manager of small works in the way of working out the problem of how best to save and dispose of an article that often was—perhaps now is—as a thorn in his side. The uses to which ammonia are applicable increase every day, and 1,000 volumes of it are now sold where 10 were disposed of a decade ago. Perhaps the most important application of it is in connection with the manufacture of ice or of cold air, and, judging from the rapid strides made in the past two years towards simplifying and cheapening the theory and practice of ice manufacture, it will not be long when Nature's function as an ice producer will have no bearing whatever on the value of that product to the consumer.

Gas Commissions and Their Powers.—Mr. Butterworth's paper, in response to the query, "Does Ohio Want a Gas Commission?" did one thing, if not any other. It proved that the sentiment in Massachusetts, as shown by the responses of the 38 replying companies to the questions forwarded them by Mr. Butterworth, is all in favor of the Commission in that State. As that is the only body of its kind in the country, or for that matter in any other country, the standing which it enjoys at home ought to be the best proof of its value. So far, and there would seem every likelihood of a continuance of similar conditions, the Massachusetts Commission has carried on its supervision in a dignified and impartial manner, and although we are not prepared to give complete assent to all its determinations, it is beyond question that none of its judicial acts can be questioned on the score that such were influenced by improper motives. We believe, however, that if the act were amended to the extent of specifying that at least one of the Board should be a lighting engineer, its few opponents would be deprived of the only argument now held by them that is at all worthy of second thought. If, then, the Massachusetts Commission, by its career covering a period of several years, has demonstrated its efficiency as a guarantee of the safety of capital from an unjust attack, and as a defender of the rights of consumers from oppressive rates or inadequate supply, we fail to understand why a similar measure would not bring about like results in other States; for, surely, the just official is not indigenous to the Bay State.

The Greenville (S. C.) Gas, Electric Light and Power Company has been organized to take over the gas and electric light works formerly operated by Messrs. R. R. Asbury & Son. The Company is capitalized in $50,000, and its officers are: President, Col. J. L. Orr; Vice-President, R. R. Asbury; Directors: N. C. Poe, J. H. Maxwell, F. W. Poe, J. G. Webb, J. W. Cagle, R. R. Asbury and J. L. Orr.

The Market for Gas Securieties.

The city market for gas shares showed more animation last week than has been the case for some time back. The dealings were not heavy, but inquiries were more numerous, and sales were effected at higher figures than those reported as a rule since the late financial flurry. Consolidated opened to-day (Friday) at 97½ to 98, and the brokers all have orders to purchase at 96, *or less*. We have all along insisted that Consolidated was a purchase at anything under par, and from our knowledge of what the Company is doing we are certain that it must go to that figure soon. Equitable is also in the ascending scale, and is quoted at 115¾, ex-dividend, which is equivalent to an advance of two points over our last. Mutual is steady to strong, with more would-be buyers than actual sellers. We note sales at auction, of 27 Consolidated gas at 97, and 200 Equitable, at 115½ to 115¾, ex-dividend. Brooklyn shares are steady and strong. The understanding is that negotiations for consolidation there are well underway, and that no serious hitch has so far been encountered. It is also the impression that the Legislature will so fix it that Brooklyn gas consumers shall not at present share in the State law making it obligatory on Companies in cities having a certain number of inhabitants to sell their product at the $1.25 rate. Brooklyn consumers will likely be called on to pay $1.50 for some time to come. We note sales at auction last week of the following Brooklyn shares: 36 Fulton Municipal, at 130¼, ex-dividend. Chicago gas is steady, at 43⅝ to 43¾, and it is very generally believed that a compromise with the city has been effected. In any event a meeting of the shareholders of the Chicago Company has been called for April 9th, at which reorganization plans are to be considered, and as it is hinted that the reorganization will be carried out under the laws of Illinois, the conclusion that a truce between the city and the Company has been arranged looks more than probable. Bay State gas is stronger, but there is no particularly good reason therefor, unless it be that the agitation for a reduction in the Boston gas rate is not so pronounced.

[Official Report.—Revised by the Secretary.—Continued from Page 442.]

SEVENTH ANNUAL MEETING OF THE OHIO GAS LIGHT ASSOCIATION.

Held at Zanesville, March 18 and 19, 1891.

First Day—Afternoon Session.

The Association re-convened at 2 P. M. On motion, invitations read by the Secretary (from the Zanesville Electric Light Company, and the Zanesville Street Railroad Company), extending courtesies to the Association, were accepted with thanks.

Mr. George Osius, of Detroit, Michigan, read his paper on

HOW A SMALL WORKS CAN PROFITABLY UTILIZE ITS AMMONIACAL LIQUOR.

Mr. President and Gentlemen: When I accepted the task which your esteemed Committee assigned to me, I expected to confine myself exclusively to a demonstration of how small an expenditure is required to save and utilize a bye-product in the manufacture of coal gas, viz: ammoniacal liquor, which has up to date received but little attention from you. In preparing my notes, however, I discovered that it is not practicable to separate such demonstrations from matters of which you are already well informed, and I am compelled to embody them in what I now place before you.

As most works, with an annual carbonization of 6,000 tons of coal and over, are already prepared for the saving of their ammoniacal liquor, I shall apply my suggestions to-day to works of from 750 tons of coal carbonized annually and upwards. Necessity of economy is a successful promoter of improvements, and the time has approached when close competition in the manufacture of light and fuel calls for the profitable saving and utilization of such bye-products as may be of use in other ways.

The ammoniacal liquor is one of these much-neglected products, and has received but little attention at the hands of the producers. A natural question arises, "How remunerative will prove our study and labor in endeavoring to create a new source of revenue?" and I will, therefore, attempt to illustrate two methods of treating the gas liquor.

Presuming there are ample scrubbing and steam facilities of proper capacity, it will be imperative that all the gas liquor, no matter of how little strength, should be collected. To accomplish this first necessity for a paying undertaking, a tank (No. 1) should be placed under ground for the collection of tar and liquor from hydraulic main and condenser. The tar will eventually settle to the bottom and permit the liquor to pass by means of an overflow into another tank (No. 2). This tank, well covered, will serve, in the course of operation, also as a storage tank; and it is advisable to have its capacity not less than 4,000 gallons. As this liquor, collected from all sources of condensation, is usually of but two or three ounces strength (equal to 1° to 1½° Twaddle), it is now required to increase its strength to the highest possible degree.

A small steam pump of 3½ in. x 2½ in. x 4 in. should, therefore, be connected with tank No. 2 and carry this weak liquor to a small feed tank (No. 3), placed over or near the top of the scrubber. This tank, being continuously filled with gas liquor, is connected to a jet or perforated coil through which the fine spray of weak liquor finds its way into the scrubber, and from there again into tank No. 2. As this process is continuous it is evident that large amounts of ammonia are eliminated. The strong liquor thus obtained will mix again with the weak liquor, and soon produce an average strength of about 9 to 10 ounces, becoming now of some value, and may be pumped by means of the same pump, as mentioned, into tank cars supplied by the manufacturer for that purpose.

As weak ammoniacal liquor has a strong affinity for sulphur, it will also aid in purification, doing some of the work which would otherwise remain to be done by oxide of iron, etc. From 15 to 20 gallons, if properly collected, can be obtained per ton of coal carbonized, and but little fresh water needs to be added for a sufficient supply to the scrubber.

It will be readily seen that no further expenses are to be incurred for the successful production of a marketable article, excepting, perhaps, a few hours of labor in preparing a shipment. Thus, with but little attention, another remunerative bye product is added to tar and coke. While the requirements of all works of such size as considered here are alike, there is little to be said of the material to be used. Have tanks Nos. 1 and 2 as large as possible, and No. 3 according to the space you have at disposal.

Where preparations of the above nature have not yet been made, and where there is only a tar tank now in use, the amount of first invest-

ment is but small, and will permit to realize at least from 10 per cent. to 75 per cent. per annum, which will grow with the increase of carbonization. A further profit arises from the improvements suggested. More or less tar will find its way into the discharge, if the gas liquor is not collected, and which may be avoided in the future.

The method which I endeavored to illustrate in the foregoing should, however, be considered as a preliminary and initiatory step toward a still more profitable operation, which should be adopted in preference to the other. I allude to the concentration of ammoniacal liquor, by means of concentrators. The same have now attained a state of perfection by which the operation of them is rendered a clean process, almost taking care of itself. It is here again where small works may avail themselves of the process, with good profits on a comparatively small investment. The process of concentrating the ammoniacal liquor at the respective gas works has two advantages over the shipment of crude gas liquor.

Firstly—It will enable you to manipulate weak or strong gas liquor, and will partly permit abandoning the mode of repumping for the purpose of preparing the liquor as a marketable product. You are, therefore, at liberty to use the liquor at its first state when leaving the tar tank The repumping, as described above, is not essential to this process, although it will shorten the time required for the production of concentrated liquor. If, therefore, a little more steam is not to be considered, introduce fresh water into your scrubber, and obtain through this a weaker but larger quantity of crude gas liquor.

Secondly—It produces an article of higher value with less labor and little expense.

Giving preference to such advantages, an apparatus for the use of gas works should be so constructed that no complications can arise while it is operated. All its parts should be accessible to inspection whenever necessity calls for it. It should occupy little space, and its construction should permit of erection or removal without expense of costly preparation. It should also be a labor-saving process, or its expense of operation will largely absorb those profits to be derived from its advantages. Its capacity must be sufficient to permit of operations at intervals, and it should then be able to consume in a few days the accumulations of crude gas liquor of weeks, perhaps of months. Its ability of consumption must be nearly equal to the highest amount of daily production of crude gas liquor. Items of additional labor should be avoided in connection with concentration, as the comparative small amount of annual proceeds from the utilization of ammoniacal liquor demands economy in all. While fuel is an item of not so great an importance with gas works as it may be with other industries where all of it must be purchased, it should, however, be taken into consideration.

If you are then satisfied that all these requirements are fulfilled by the use of such an apparatus, there is nothing to prevent the adoption of a successful and paying device. Assuming, then, that you have obtained what is here described, the apparatus will reduce the quantity of crude gas liquor to about one-tenth of its former bulk by means of liberating the ammonia gas contained in the gas liquor, and transforming it by condensation into a liquor of high strength. The same is collected in an absorber (part of the apparatus), and runs into a storage receptacle large enough to accumulate a shipment, which can either be made in tank cars or in iron drums provided for that purpose by the purchaser. The filling of the same can be accomplished by pump or gravity, whichever arrangement can most conveniently be made. It is also in this case advisable to have the storage tank for the finished product as large as practicable, and as the material is of much greater value than that derived from the first method mentioned, I recommend the use of an iron tank, free of leaks and in sound condition. The same, if of iron, may be placed at the nearest convenient location, and is better taken care of when above ground, as any possible loss by leakage or evaporation can then be easily detected and remedied.

The annual results of this latter plan of producing strong ammoniacal liquor will net you, with proper care and attention, from 25 per cent. to 125 per cent. on the invested money, and may largely surpass even this with an increase of carbonization. The first expenditures are not larger for works carbonizing 6,000 tons of coal, than for others with only 750 tons of carbonization per annum, which is the smallest size considered in my suggestions.

I have not mentioned the third method, and another way of utilizing profitably your ammoniacal liquor, viz: The manufacture of sulphate of ammonia. As my aim is largely to suggest to works with less than 6,000 tons of annual carbonization of coal the most profitable method of utilization, I have confined myself solely to the subject of the manufacture of products better adapted for small works, which do not involve quite as large investments and such careful attention as does the production of sulphate of ammonia.

As it may be of interest to some of you to see some of the practical results of a systematic utilization of a former waste product, I have obtained a few specimens of the most popular products and placed the same on the table for your inspection.

I have in this bottle some of the crude gas liquor of 8 ounce strength, as it came from the tar well; also a bottle of the concentrated ammoniacal liquor, of 60-ounce strength. This is a sample of the purified product, aqua ammonia of the strongest quality; and here is another product, carbonate of ammonia, which is now largely used for baking powders and so forth.

Discussion.

The President—You have heard a very interesting paper by Mr. Osius on a subject in which all gas men are interested. As he is entirely familiar with the subject, I am sure he would be glad to answer any question you may address to him.

Mr. Clapp—Does Mr. Osius mean that he can get 18 to 20 gallons of ammoniacal liquor per ton of coal, at its full strength?

Mr. Osius—Yes; in some cases it is a trifle less, in others a little more. You can easily figure on 15 gallons of liquor, with an additional 8 to 10 gallons of fresh water, which will come up to about 20 to 25 gallons of 8-ounce liquor.

The Secretary—Is it the experience of those engaged in the manufacture or utilization of ammoniacal liquor that a sulphate works requires more care and attention than a concentrator?

Mr. Osius—Personally I have had no experience in making sulphate of ammonia, but from what I hear from others it would seem to tend in that direction. The process of making the sulphate of ammonia is a little more complicated than that of making the concentrated liquor, because you need another product—the acid—in obtaining the sulphate of ammonia. The acid is not very pleasant to deal with; and otherwise I think it needs more attention, so far as the heat and temperature are concerned. In all cases I have found the manufacture of the concentrated liquor easier, and that it requires but very little attention. Of course the collection of the crude gas liquor is attended with no extra attention whatever.

Mr. Cantine—The percentage of profit in this strikes me very favorably. It certainly seems worth one's while to attempt it. I would like to ask Mr. Osius if, after taking all the ammoniacal liquor that he has or that he can get, is the wash or escape from the works as odoriferous as the spices of Arabia? What is the nature of the stuff that leaves the works—whether you get the whole odor or let some of it go off down the drain. Having had that question to meet, the answer I gave was that nobody seems to be sick in the neighborhood; that, while the smell might be a little offensive, there was no malarious or fever disease, or anything of that kind around. Is it possible to take all the odor out, so that the drain will receive none?

Mr. Osius—This deposit does not cause objectionable odor. That to which you refer is probably caused by the making of the sulphate of ammonia, on account of the acids used. The only objectionable odor here is the ammonia itself. That is what we want to keep, and, therefore, nothing is allowed to escape. The discharged stuff is neither more nor less than boiled water having a little sulphur in it, but fixed so that there will be no odor whatever. The process in some instances is automatic. The gas and water are injected in one part of the apparatus, and it leaves the apparatus on the other side simply as boiled water, after the ammonia is all liberated, so there is no ammonia whatever connected with it.

The Secretary—Mr. Osius what have you found by experience to be the best method of getting rid of the sulphureted hydrogen evolved and passed off into the open air, unless you get rid of it otherwise?

Mr. Osius—Do you refer to the discharge of the gas water?

The Secretary—No. The sulphureted hydrogen gas is evaporated, and unless you absorb or burn it, it must pass into the open air. It is not all taken up by the concentrated liquor.

Mr. Osius—No; but it seems in this case the steam will absorb it; that is the only explanation I can make. The steam must absorb it, because there is no possible chance of any kind to find that odor.

The Secretary—We found this the most serious nuisance we had to contend against in connection with the operation of our concentrator—the taking care of the sulphureted hydrogen gases that escape. We have the Clapp process, and had to build a regular purifying house at our ammonia works, using oxide of iron to remove the sulphureted hydrogen.

Mr. Osius—I have not worked actually with the Clapp process, but some other processes that I have in mind are not faulty in that respect. One apparatus has no vent pipe whatever, and yet no odors of any kind are derived from it.

Mr. Clapp—I do not think we have yet learned very much as to whether it is profitable to us to save the crude liquor from the works.

That is what I am very much interested in. Will it pay us to save the liquor itself and ship it? We know about how many gallons we get now, and I would like to know what it is worth.

Mr. Osius—As far as the value of the liquor is concerned, I stated that in percentage on the investment, which would probably be the only way to deal fairly with the question in a paper. It is a matter of market price and of business. I suppose whoever will offer the best price for the liquor will get it. You will find that on an average a yield of from 20 to 25 gallons is not higher than practical results have shown in several works that I might name. The results in that way, without concentrating the liquor (which, however, should be a part of the process) are less than they would be otherwise. It requires a small investment and no labor. The investment involves only the purchase of two tanks, a small box, or "tank, No. 3" as I call it in my paper, and a pump. The pump can be had for $50 or $55. The expense of the two tanks will not be over $200, and the incidental expenses will not bring the whole investment up to more than $300 or $350. This would be only for the saving of the crude gas liquor. Of course the freight is just as high on the crude as on the concentrated liquor, therefore, the market price is naturally much less than it is for the concentrated liquor. The general assumption is that simply with the collection of the crude gas liquor, from 10 to 15 cents per ton of coal carbonized can probably be gained; but the gain is naturally much higher with the concentrated liquor. It also depends greatly upon the care and attention given to the matter in the gas works.

Mr. Cantine—I would like to ask some of the gentlemen who manage the larger works, and who are in this business, whether they have found the manufacture of ammonia, in connection with their other business, profitable? Have they found sale for that commodity at a price which enables them to make any money on it? I am pretty well aware that nature has about quit furnishing us ice, and to a certain extent this seems to be about the stuff to make it out of. If this state of things goes on, it seems to me it will encourage the manufacture of that commodity in our smaller works. I do not know what has changed the seasons—whether the electric light gentlemen, in running their wires around the country, have managed to change the whole course of nature, and sent all of the cold weather off to the North Pole, or what is the cause. But this is a subject that you can get right down to business on. You see what is necessary. We have had two or three winters when we could store very little ice—you can manufacture it very nearly as cheap by this process; and that fact seems to open up a way for the sale of this residual. I think the ordinary uses of ammonia would not justify every gas works, large and small, in going into that business. Am I right in that?

The President—I quite agree with you.

Mr. Cantine—In works as small as ours, it is an open question whether we can go into the business successfully or not. Mr. Osius' paper seems to give a little encouragement. I would like to get rid of this odoriferous business, and to do so at not too great an expense. If I can get out even on it, I would adopt it.

The President—Mr. Harbison is in the ammonia business, and can probably throw some light on the subject.

Mr. Harbison—I have not a great deal of information on that point. The concentrated information on that subject for all New England is carried by Mr. Humphreys, whom I brought with me on this trip for the purpose of giving the Ohio Association positive information on many of these points. On this subject in particular he is an expert. You all know that he is unusually modest. As to the concentrated liquor method, I may say we have for a third of a century or more been helping our health department by running some of the bye-products into the river which runs across our city and past our gas works, and which takes the sewerage of the city largely, and it caused a good deal of annoyance to some of the residents; but below the gas works there is no trouble. The health authorities have so testified, and their testimony is on record. We purified the stream from the works down to its outlet. But of late years we have given up that part of our benefits to the city, and have been trying to make an honest dollar out of them. We have been trying to concentrate our ammonia with a greater or less degree of success; and by way of reply to the question just now asked, whether there is any market for it, I will say that within the past 2 or 3 weeks, the gentleman who has contracted for our product has voluntarily increased the price which he pays us, from 25 to 40 per cent., so that it is becoming more valuable. I think it would pay any gas manager consuming from 250 to 1,000 tons of coal per year to concentrate his ammonia. The means of doing it are very simple and are not expensive. But in regard to the practical information about it, ask Mr. Humphreys.

The President—Will Mr. Humphreys kindly give us the information?

Mr. Humphreys—I am obliged to my friend Harbison for his flattering remarks. With regard to the ammonia question, I may say our experience has been in two directions—that of concentrating, and also in manufacturing the aqua ammonia. We make the aqua now almost entirely, concentrating but little, for the reason that we have been able to build up a splendid market for the aqua ammonia; and I think it is a market which almost any company can build up, if it will set itself to work to do it. We have three large lines of customers—the mills, where they use aqua ammonia (but that demand, perhaps, would not be found by the gas companies in this neighborhood), the druggist trade, and the household trade. We have a very large sale in Lawrence, and through New England, of bottled ammonia. We take the weaker grades of aqua ammonia, put it up in ammonia bottles with fancy or rather gaudy labels, and advertise it freely, so that now we are supplying all the ammonia used in Lawrence for household purposes. I do not know of any wholesaler who used to come to Lawrence and supply the grocery trade with ammonia who still continues to do so; for we have got all of that trade. We also supply some of the larger cities in New England, where the large dealers buy perhaps 50 gross of us at a time. And then we have, also, the ordinary druggist trade. So that we have worked up there quite a good trade for the aqua ammonia. This, however, hardly comes within the scope of the paper read by Mr. Osius, because it certainly would not be profitable for works carbonizing 750 tons of coal per year to go into the aqua business; but I should certainly think it ought to pay any company to concentrate the ammonia. I do not see why it should not. The only reason why we do not concentrate it is that we can get more money out of it by continuing the process and making it into the aqua direct. Of course the question would come up, How far would you have to send the concentrated liquor? I think there is where the matter hinges, for small works, or in fact for any works where the freight would eat up the profits. I think each individual company will have to work that problem out for itself, and find out where it can obtain a market for the concentrated liquor, find what the freight rates are, and then it can figure out very easily whether it would pay it to go into the business of concentrating the liquor.

Mr. Clapp—I would like to ask Mr. Humphreys how much concentrated liquor he obtains per ton of coal.

Mr. Humphreys—I forget just the figures, but I think I am now getting about 40 pounds of aqua ammonia per ton of coal, and I think I obtain the equivalent of 25 gallons of 10-ounce liquor. I measured it before it was concentrated, but I think that is about what I obtain. I do not know that I ever figured out the amount of concentrated liquor obtained per ton of coal.

Mr. Harbison—Mr. George Shepard Page, who called upon me two or three weeks ago, told me that at Altoona they were receiving more than 20 cents per ton for every ton of coal carbonized for their ammoniacal liquor. And as to the market for it—you have all heard of Page. I am not his advertising agent, but I may say I do not think any of you would have any difficulty in making a contract with him.

The Secretary—We have had no trouble in disposing of our concentrated liquor. We net, as near as we can arrive at it, 25 cents per ton for every ton of coal we carbonize, from our ammonia works, not counting the interest on the plant, which is not very much.

Mr. Phillip—What kind of pumps are necessary? Will ordinary steam pumps do? Will not the liquor cut out the working part of the pumps?

Mr. Osius—Any steam pump will answer the purpose. We have a pump particularly constructed for that purpose, made of iron having no brass whatever connected with the parts, and, therefore, it is very suitable for that purpose, as ammonia will not affect it. I wish to state, also, in connection with what has been said, that I have endeavored to keep my own business interests separate from my membership of this Association. I have given this paper, as a member of the Association, and not as a manufacturer of ammonia; but in reply to the question which has been asked with regard to a market for the product, I will state I am ready at any time to contract with companies for their product, as in our business we consume large quantities of ammoniacal liquor.

On motion of Mr. Cantine, a vote of thanks was passed to Mr. Osius.

Mr. Irvin Butterworth, of Columbus, read his paper, entitled

DOES OHIO WANT A GAS COMMISSION?

The idea of my investigating this subject and undertaking the preparation of a paper thereon for this meeting, was suggested by the fact that the President of the Western Gas Association, at its meeting last May, and the President of the American Gas Light Association, at its meeting last October, both being Ohio men, advocated in their inaugural

addresses the formation of State Gas Commissions. It occurred to me that when two such representative and progressive Ohio gas men, coming from different sections of the State, and speaking independently of each other in the matter, should thus advise or suggest the creation of these boards, such a measure was not only well worthy of careful consideration by all, but would also naturally be expected to be particularly applicable to, and desirable by, their own State.

The fact, also, that the Massachusetts Board of Gas and Electric Light Commissioners has now been in existence for six years, from the operation of which we could help form our judgment as to the desirability of a similar board for Ohio, and that the subject has not been discussed in any of our gas association meetings, and but very little in the gas journals, since 1887, or for about four years, during which interval conditions affecting this question may have somewhat changed, were other considerations leading to the belief that the subject could be profitably discussed at this time, in the light of the experience of the past four years.

If the question, "Does Ohio want a Gas Commission?" were to be *literally* answered, the task would be a comparatively easy one. It would simply involve the obtaining of an expression upon the subject from each gas company in the State, and noting whether a majority of them expressed a desire for a commission. But the real question proposed for consideration, "Do Ohio gas companies *need* a gas commission?" or, "Would a gas commission be advantageous to the gas companies of Ohio?" is much more difficult to answer; in fact, any solution of it short of actual trial or experiment, or a series of them, would be, and doubtless will be, a matter of opinion and not of demonstration.

However, a literal answer to the question will not only be interesting and valuable in itself, but will be very helpful in enabling us to arrive, as nearly as possible, at an answer to the real question. Accordingly I have written to each gas company in Ohio, inclosing a number of propositions bearing on the subject of a gas commission for this State, patterned more or less after the one in operation in Massachusetts, and expressing as many shades of opinion thereon, from enthusiastic approval down to decided opposition, as it was thought likely would be entertained by the different companies, each company being requested to draw a pen through all the propositions except the one which most nearly expressed its views. Notwithstanding the facilities for thus voting upon the question with ease and economy were further increased by the inclosure of a self-addressed and stamped envelope, responses were received from only a little over one-half of the companies of the State. Forty-seven out of a total of 79, or nearly 60 per cent. sent in their replies, a tabulation of which is as follows:

1. We are not familiar with the workings of the Massachusetts gas commission, and therefore do not know whether a commission for Ohio would be desirable 23
2. We are in favor of a gas commission for Ohio, patterned more or less after the one in Massachusetts..... 13
3. We are opposed to the formation of a gas commission in Ohio 4
4. We are in favor of some sort of a gas commission in Ohio, not necessarily patterned after the one in Massachusetts 2
5. We are only slightly familiar with the workings of the Massachusetts commission, but do not see wherein a commission for Ohio would be of any benefit to this company..... 2
6. We are only slightly familiar with the workings of the Massachusetts commission, but are inclined to favor the formation of a commission in Ohio..... 2
7. We are only slightly familiar with the workings of the Massachusetts commission, but are inclined to oppose the formation of a commission in Ohio..... 1

From the foregoing it will be seen that out of 79 gas companies in the State, only 15 (classes 2 and 4), or less than one-fifth, voted in favor of gas commission; while out of the 47 votes actually cast, a little less than one-third were in favor of a commission. Under our State laws, when a special proposition is to be voted upon at a general election, votes not actually cast for the proposition are counted against it. If this rule should be applied to this straw vote, we should be obliged to say that it stood 15 for a commission to 32 against it. But legislators are beginning to see the injustice of this law, and very correctly argue that a majority of the votes cast, either for or against a measure, should determine the matter; that those who have not taken sufficient interest in the proposition to vote upon it one way or another should not be counted as voting against it. Applying this correct principle to the present vote, we find that it really stands 15 for a commission to 4 against it. From this we can, I think, properly assume that if all the companies of the State should familiarize themselves with the workings of the Massachusetts commission, and should give the subject of a commission of some sort for Ohio due consideration, about three-fourths of the total number would be in favor of a commission.

Evidently, however, it must be confessed that if Ohio gas companies *need* a commission, they certainly do not *want* one, in the sense of being aware of their needs, if we may judge by the failure of so many of the companies to respond to the request to express their opinion, and the candid confession of one-half of those who did respond that they did not know whether or not they wanted a commission. If a commission would really be advantageous to the gas companies of Ohio, and is to be striven for, it is apparent that what politicians term "a campaign of education" will have to be carried on among these uninformed or apathetic companies by those who believe in the desirability of a commission. And as stated above, the responses already received would seem to indicate that after such a campaign should have been conducted, three-fourths of the companies would vote in favor of a commission.

As a small contribution towards this "campaign of education," I shall here present a compilation prepared by Mr. Allen R. Foote, of the laws creating and controlling the Massachusetts Board of Gas and Electric Light Commissioners, and an outline of a commission for Ohio suggested by Gen. Hickenlooper in his inaugural address to this Association at its second annual meeting in 1886, which plan, with possibly some slight modifications, is, I believe, still favored by him. Both the Massachusetts law and the one proposed by Gen. Hickenlooper have been heretofore published in the gas journals, and the presentation of them here will occupy considerable space; but my apology, under the circumstances, is that the proceedings of this meeting are to be published in pamphlet form, of which pamphlet each member will receive a copy, and thus have brought before him, in convenient shape for perusal and future reference, subject matter from which he may, if he has not already done so, lay the foundation for an opinion upon this question.

The compilation of the Massachusetts law is as follows:

AN ACT TO ESTABLISH A BOARD OF GAS AND ELECTRIC LIGHT COMMISSIONERS.

Be it enacted, etc., as follows:

SECTION 1. The governor, by and with the consent of the council, shall appoint three citizens of this commonwealth, who shall constitute a board of gas and electric light commissioners, and the governor shall designate the chairman thereof. Said board shall have a clerk, to be appointed by the governor with the consent of the council, who shall keep a full and faithful record of its proceedings, and shall serve such notices and perform such other duties as the commissioners may require, and shall be sworn before entering upon the discharge of his duties.

SEC. 2. One of said commissioners shall be appointed for one year, one for two years, and one for three years from the first day of July, 1885; and annually thereafter the governor shall appoint, as hereinbefore provided, one commissioner to serve for three years from the first day of July in the year of his appointment, and until his successor is appointed and qualified. If a vacancy occurs by resignation or otherwise, the governor shall in like manner appoint a commissioner for the residue of the term, and may, with the consent of the council, remove any commissioner for cause after notice and hearing.

SEC. 3. Said commissioners shall be sworn to the faithful performance of the duties of their respective offices before entering upon the discharge of the same, shall not be in the employ of or own any stock in any gas company or be in any way directly or indirectly interested pecuniarily in the manufacture or sale of gas, or any article or commodity used by gas companies or used for any purpose connected with the manufacture and sale of gas.

SEC. 4. The annual salary of the chairman of the board shall be $3,000, and that of the other commissioners $2,500 each, to be paid monthly from the treasury of the commonwealth. The commissioners shall be provided with an office in the State House or in some other suitable place in the city of Boston, in which their records shall be kept.

SEC. 5. The board may expend a sum not exceeding $1,000 annually in procuring necessary books, statistics and stationery and defraying expenses incidental and necessary to the discharge of their duties; and a sum not exceeding $2,000 annually in defraying the compensation and expenses of their clerk, payable monthly from the treasury of the commonwealth.

SEC. 6. Said board shall have the general supervision of all corporations engaged in the manufacture and sale of electric light or of gas for lighting and for fuel, and shall make all necessary examinations and inquiries and keep themselves informed as to the compliance of the several corporations with the provisions of the law.

SEC. 7. Every gas and electric light company shall annually make a

return to said board, in a form prescribed by said board setting forth the amount of its authorized capital, its indebtedness and financial condition on the thirtieth day of June preceding, and a statement of its income and expenses during the preceding year, together with its dividends paid or declared, and a list containing the names of all its salaried officers, and the amount of the annual salary paid to each; and said return shall be signed and sworn to by the president and treasurer of said company and a majority of its directors. Every such company shall also at all times, on request, furnish any statement or information required by the board concerning the condition, management and operations of the company, and shall comply with all lawful orders of said board.

SEC. 8. Every company engaged in the manufacture and sale of gas or electric light shall keep its books and accounts in a form to be prescribed by the board, and the accounts shall be closed on the thirtieth day of June in each year, so that a balance sheet of that date can be taken therefrom and included in the return required by the preceding section, which return shall be for the year ending the thirtieth day of June, and shall be made by the Board of Gas Commissioners on or before the second Wednesday of September in each year; *Provided*, That manufacturing companies in which the manufacture of gas or electric light is a minor portion of their business shall only be required to keep accounts of the expenses and income of their gas and electric light business. The board shall prepare such abstracts of the returns as it shall deem expedient, and shall transmit said abstracts, together with its annual report, to the secretary of the commonwealth on or before the first Wednesday of January in each year, to be laid before the general court. Three thousand copies of said document shall be printed for publication and distribution as one of the series of public documents.

SEC. 9. Every gas or electric light company shall have an office in the city or town in which its works are located, and shall keep in said office all the books and papers now required by law to be kept within the commonwealth, and also such books as may be required to show its receipts and expenditures, and its indebtedness and financial condition; and shall at all times, upon application, submit its books to the inspection of the board.

SEC. 10. Upon the complaint in writing of the mayor of a city or the selectmen of a town in which a gas or electric light company is located, or of twenty customers of such company, either of the quality or price of the gas or electric light sold and delivered by such company, the board shall notify the company of such complaint by leaving at their office a copy thereof, and shall thereupon after notice give a public hearing to such petitioner and such company, and after said hearing may order, if they deem just and proper, any reduction in the price of gas or electric light or improvement in quality thereof; and they shall pass such orders and take such action as are necessary thereto, and a report of the proceedings and the result thereof shall be included in their annual report to the legislature.

SEC. 11. Upon the petition in writing of any person who has a residence or place of business in a city or town where a company is engaged in the manufactune and sale of electric light or gas for lighting or for fuel, and who is aggrieved by the refusal or neglect of such company to supply him with gas or electric light, the Board of Gas and Electric Light Commissioners shall have authority to issue an order directing and requiring such company to supply such person with electric light or with gas for either of said purposes, upon such terms and conditions as are legal and reasonable. Said board shall not issue its order under this section except after notice to such company directing it to appear at a time and place therein named to show cause, if any there be, why the prayer of such petition should not be granted.

SEC. 12. In any city or town in which a gas company exists in active operation no other gas company nor any other persons shall dig up and open the streets, lanes and highways of such city or town for the purpose of laying gas pipes therein without the consent of the mayor and aldermen or selectmen of such city or town after a public hearing before said mayor and aldermen or selectmen and notice to all parties interested by publication or otherwise.

SEC. 13. The board shall from time to time ascertain with what degree of purity the gas companies can reasonably be required to make and supply gas; and if any change in the existing laws regarding purity in gas shall be, in their opinion, desirable or expedient they shall so report to the legislature in their next report.

SEC. 14. Nothing in this act shall affect the office of gas inspector as constituted by chapter sixty-one of the Public Statutes, excepting that said inspector shall, whenever requested by the board, give to them such information and assistance as they may require, consistent with the duties of his office.

SEC. 15. In any city or town in which a company is engaged in or organized for the purpose of the manufacture and sale of electric light no other company shall lay or erect wires over or under the streets, lanes and highways of such city or town for the purpose of carrying on its business without the consent of the mayor and aldermen of such city or selectmen of a town after a public hearing and notice to all parties interested.

SEC. 16. The board, whenever any gas or electric light company violates or neglects in any respect to comply with the provisions of any law, or refuses or neglects to comply with any lawful order of the board, shall give notice thereof in writing to such corporation and to the attorney-general, who shall take such proceedings thereon as he may deem expedient.

SEC. 17. Any court having jurisdiction in equity, in term time or vacation, may, on the application of said board, by any suitable process or decree in equity, enforce the provisions of this act and the lawful orders of said board.

SEC. 18. The board shall make an annual report of its doings to the legislature in January, with such suggestions as to the condition of affairs or conduct of the gas or electric light companies as may be deemed appropriate.

SEC. 19. Any company or person aggrieved by the decision of the mayor and aldermen of a city or selectmen of a town under the provisions of sections twelve or fifteen of this act may appeal therefrom to said board within thirty days from the notice of said decision, and said board shall thereupon give due notice and hear all persons in interest, and its decision thereon shall be final.

SEC. 20. The board, upon application in writing by any company organized or chartered under the laws of the commonwealth for the purpose of making and selling gas for illuminating purposes, may, after such notice and hearing as said board shall deem proper, authorize said company to engage in the business of generating and furnishing electricity for light and power in all or such part of the territory in which it is authorized to supply gas as said board may designate; *Provided, however*, That said company shall not engage in said business so authorized unless by vote of two-thirds of the stockholders, representing not less than two thirds of the stock, at a meeting duly called for that purpose. Said company so authorized shall file in the office of the secretary of the commonwealth a certificate of such addition to the business, as provided in section fifty-one of chapter one hundred and six of the Public Statutes.

SEC. 21. Said board shall, at the time of granting said authority, prescribe the time, not exceeding six months, within which said company shall erect and equip such a plant for generating electricity for light and power as may be required in the specified territory, and designate the minimum capacity of such plant; and, if said company shall neglect to erect and complete said plant within the time prescribed, said authority shall thereupon become void, and no such authority shall be again granted to said company within two years thereafter; *Provided, however*, That said board may, for cause shown, extend the time first prescribed for erecting and equipping said plant not more than three months from the expiration of the time first prescribed.

SEC. 22. At the expiration of the time and extension thereof, if any, given under the preceding section, said board shall, after such examination as they shall deem proper, make, in a book kept by them for that purpose, a record as to whether their orders with reference to the erection and completion of said plant have been complied with. Said record shall be conclusive evidence of the truth of the matters stated therein.

SEC. 23. Said company so authorized, except in cases of the purchase or lease of the property, licenses, rights and franchises of some electric light company as authorized under section twenty six of this act, shall not erect or maintain any poles for the support of wires, nor erect or maintain any wires in, through or over any streets or highways, nor dig up any streets or highways for the purpose of laying said wires underground, until it has (upon petition in writing by said company) first obtained the consent in writing of the mayor and aldermen of cities or selectmen of towns in which said streets are located.

Said company, having obtained such consent, may, under the direction and control of the mayor and aldermen or selectmen, dig up and open the grounds in any streets and highways, so far as is necessary, for the purpose of laying lines of wires to carry into effect the authority given under this act, and for the purpose of keeping said lines in repair, and to erect and maintain lines of wire upon or above the surface of such streets and highways.

The said company shall put all streets and highways which are opened into as good repair as they were in when opened, and after failure so to do within a reasanable time shall be deemed guilty of a nuisance.

SEC. 24. Gas companies, as respecting the business in which by this

act they are authorized to engage, shall be subject to the control of the board in the same manner and to the same extent they now are or hereafter may be respecting the business of furnishing gas.

SEC. 25. Except as hereinbefore expressly provided, gas companies shall (in exercising the powers conferred by section 20) have all the powers and privileges and be subject to all duties, restrictions and liabilities set forth in all general laws which are now or hereafter may be in force relating to companies engaged in the transmission of electricity for light and power.

SEC. 26. Said gas companies so authorized by the board shall have the right to purchase or to lease and to use all or any of the property, licenses, rights, privileges and franchises of any electric light company engaged in the business of furnishing electric light or power in the territory in which such gas company may be authorized to furnish such light or power.

SEC. 27. The provisions of the seven preceding sections shall apply to electric light and power companies.

SEC. 28. Any gas company in this commonwealth, whether furnishing gas under the provisions of general laws or of any special charter or of any contract with any city or town, may apply to the board of gas and electric light commissioners to fix and determine the price of the gas to be thereafter sold and delivered by said company, or to revise any former order or action of said board in regard to the quality or price thereof. Said board, after such notice as it shall deem expedient, shall give a public hearing on such application to the petitioner and to the city or town and such other persons interested as may desire to be heard, and thereafter may pass such orders and take such action in regard to the subject matter as it may deem just and reasonable, and the orders and decrees of such board in relation to the price and quality of the gas thereafter to be furnished by said company shall be thereafter binding upon all parties until further order of said board.

Whenever, pursuant to section ten, the said board has ordered a reduction in the price of gas or improvement in quality thereof, the maximum price fixed by such order shall not be increased by the company named therein, except in the manner herein provided.

SEC. 29. All companies and individuals engaged in the business of manufacturing and selling gas or electricity for light or fuel shall make a written report within 24 hours to the board of gas commissioners of every accident caused by the gas or electricity manufactured or supplied by them, whereby an employee or any other person shall suffer bodily injury, or loss of life, or be rendered insensible, stating the time, place and circumstances of the accident, and such other facts in relation thereto as the board may require; and the board shall present in its annual report an abstract of all such cases. The board sha'l personally investigate all cases which it may deem to require investigation.

SEC. 30. The annual expenses of the commissioners and clerk, including salaries, shall be borne by the several gas and electric light companies, in proportion to their gross earnings, and shall be assessed and recovered in the manner provided for the assessment and recovery of the expenses of the railroad commissioners.

SEC. 31. In the construction of this act, the terms "company" and "companies" shall be deemed to include also all corporations or individuals engaged in the business of manufacturing and selling gas or electric light within this commonwealth.

SEC. 32. This act shall take effect upon its passage.

The outline of the law suggested by Gen. Hickenlooper is as follows:

"Any State Commission should, as nearly as may be practicable, embrace a representative of each of the interests involved—of the State, of the companies, and of the municipalities; the first to be appointed by the Governor, the second to be selected by the gas companies of the State, and the municipality to be represented by its chief executive officer. The first should possess legal, scientific and clerical ability of the very highest order; the second should be a gas engineer eminent in his profession. These two should be appointed for a period of not less than five years; be required to give their entire time and attention to the duties of the office; be paid a salary of not less than $8,000 per annum; should be furnished with a well appointed and thoroughly equipped department in the capitol of the State—speaking for Ohio, the gas works at the Ohio Penitentiary should be placed under their exclusive charge for test and experimental purposes; and they should be at all times prepared to furnish accurate, detailed information in regard to the industry they represent. The chief executive of any city or town to be called upon to act as a member of such commission whenever proposed action directly affects the interest of the municipality he represents.

"Such commission should first be required to make a thorough examination of the business and financial affairs of existing companies; and from such examination, coupled with due consideration of the present and prospective requirements of the business, fix and determine upon a fair and reasonable allowance of capital representing invested values, or necessary for properly conducting the business. With this as a basis, they should then definitely determine upon the divisible profits to be allowed upon authorized capital uniformly throughout the State. They should then prepare a bill expressing with great exactness the rights, duties and obligations of both manufacturer and consumer; confining their own discretionary power to the narrowest possible limits, but investing them with ample authority to enforce an exact compliance with the law upon the part of municipalities, as well as corporations accepting under its provisions.

"In the absence of general detailed information, and official statistics, it is impossible to even approximate to an indication of all the necessary details and provisions of such an act; but in general terms I would say that, under existing circumstances, companies now doing business in this State should be permitted to accept on a capital basis of ten dollars ($10) per thousand cubic feet of sendout. That upon such authorized capital they should—after due and proper allowance for maintenance of plant—be permitted to make a divisible profit of 8 per cent., and accumulate a reserve fund, at the rate of 2 per cent. per annum, until it amounts to a sum equal to 10 per cent. of the authorized capital; such reserve to be drawn upon only in case of unavoidable accidents, unexpected enhancement of the value of the materials used, great temporary depression in business, or other unlooked-for contingencies, that would render it impossible to earn in any one year the authorized dividend.

"Whenever any company has secured the authorized reserve, and demonstrated its ability to earn the maximum dividend, it shall call upon the commission to make an examination of its accounts; and, upon the basis of the last preceding year's receipts and expenditures, to fix and determine upon the price at which it shall thereafter sell gas to public and private consumers in order that they may realize the required profit. That it shall not, for a period of 25 years thereafter, be legal to charge more, or require such company to furnish gas at less than the price thus fixed and determined upon; but that, for the purpose of insuring the utmost economy in the manufacture and management, any company so electing may at any time reduce the price below that indicated, and, in consideration of such reduction, shall be permitted to increase their authorized annual dividends to the extent of 1 per cent. for each and every reduction of ten cents per thousand in the selling price. That existing gas companies should have a reasonable time, after the final passage of such a bill, within which to examine and consider its provisions, pending which examination no authority should be given for the establishment of additional companies.

"Whenever any company officially signifies to such commission its desire to accept under the provisions of such a bill, it should not thereafter be lawful to authorize the establishment of any other gas company within the territory occupied by such existing company. That such acceptance shall constitute a contract between the corporation and State, the terms and provisions of which should not thereafter be subject to amendment or appeal except by mutual consent. Such an arrangement would, in my opinion, prove eminently satisfactory to all concerned."

It will be seen that the Massachusetts law and the one suggested by Gen. Hickenlooper are somewhat radically different; and without attempting to discuss their relative merits, in my judgment a law more or less similar to that in Massachusetts would be much more easily placed upon our statute books than would one following closely Gen. Hickenlooper's outline, notwithstanding the latter possesses many excellent features that the former lacks, among them the very desirable one, to both gas companies and gas consumers, of permitting an increase of 1 per cent. in annual dividends to every reduction of 10 cents in the selling price of gas; being, in this respect, patterned after the English laws governing gas companies, under which, and largely by virtue of which, English companies are able to sell gas at cheaper rates than prevail in the United States.

Now that the Massachusetts Gas Commission has been in operation for six years (their sixth annual report being now in the hands of the printer), the opinion with which Massachusetts gas companies regard their commission at the present time will properly have a decided influence in our determination of the desirability of a commission for Ohio, or for other States. In order to obtain this opinion from the Massachusetts companies, I sent to each a letter containing the following questions:

1. "Are you thus far satisfied with the workings of your gas commission, and do you desire its continuance?"

2. "What changes, if any, would you now suggest in the laws governing it?"

Responses were received from 38 companies out of a total of 78, or about one-half. Of the 38 responding, 32 answered the first question affirmatively, three answered negatively, two were indifferent or undecid-

ed, and one answered "yes," with qualifications; four of those answering affirmatively suggested two changes in the law, viz., that at least one member of their board should be required to be thoroughly familiar with the gas business, and that the term of office of the members should be increased to about four or six years.

I am sure you will agree with me that these answers, 85 per cent. of which heartily indorse the commission, are very reassuring. Gas companies, gas consumers, local and State politicians, and human nature generally, are probably very much alike in both Massachusetts and Ohio; and there seems to be no good reason why, if a gas commission is so eminently satisfactory in Massachusetts, to both company and consumer, it should not be equally so in Ohio.

But the most significant and beneficent result in Massachusetts of the creation of their commission, and the one that will probably appeal most strongly to the directories of gas companies elsewhere, is that their law, while imposing many restrictions and obligations upon the gas companies in the interest of their consumers and the public, has at the same time given such assurance that the companies will receive just treatment, and be protected in the stable possession of their proper rights, that the market value of the stocks of prosperous companies has shown a very decided increase. Lest this fact should be misunderstood by the public, who might, in the absence of correct explanation, imagine that such a result could not follow unless the law in some way unduly favored the gas companies to their (the public's) disadvantage, probably it should not be further alluded to at this time. Nevertheless, if this has been the legitimate effect of a commission in the State of Massachusetts, where city councils previously had no power to regulate the price of gas, could we not reasonably expect results similar in nature, and at least equal in degree, were a commission established in Ohio, where gas companies (and the public also) are at present constantly exposed to the danger of unwarranted and ruinous competition through a duplication of works; where the companies are periodically harrassed, annoyed and probably put to much expense through the misguided efforts of city councils to arbitrarily fix the price of gas at an unreasonably low figure; and where, in the absence of a shield in the shape of a commission, gas interests are being constantly jeopardized by petty and hostile legislation such as is now pending before our General Assembly?

In what I have written I have adduced none but what might be termed inferential arguments in favor of a gas commission for Ohio. I have simply pointed out three facts—(1) a vote of 15 to 4 by Ohio gas companies in favor of a commission (and I might add that the 15 include most of the leading and influential companies); (2) a vote of 32 to 3 by Massachusetts companies expressing great satisfaction with their commission and a desire for its continuance; and (3) a marked increase in the value of Massachusetts gas securities due to their commission; and I submit that a natural conclusion from the consideration of these facts would seem to be that an affirmative answer to the question constituting the subject of this paper would be correct.

It is not my purpose, even if this paper were not already too long to admit of it, to undertake the discussion of the abstract and *a priori* arguments, pro and con, as to the necessity or desirability of a gas commission for Ohio. And indeed it were better that these arguments be discussed by the gas companies themselves, than by a body of individuals such as properly compose our Association. But it should be admitted that the arguments against a gas commission are very weighty, and there are emphatically two sides to this question. The burden of proof resting with the advocate of a measure, it would properly be incumbent upon me to show wherein the arguments *for* outweigh the arguments *against* a gas commission. But able members of our profession have, at various gas association meetings in the past, thoroughly gone over the ground, and I would have nothing to add. As I stated at the outset, the conclusion would be a matter of opinion, after all, rather than of demonstration, unless, indeed, we could regard the results in Massachusetts as a demonstration.

For the benefit of any who may desire to read, or re-read, the arguments just referred to as having heretofore been made upon this question, I will state that the discussions can be found in the AMERICAN GAS LIGHT JOURNAL of the following dates: July 2 and 16, Nov. 16 and Dec. 2, 1886; Feb. 16 and April 2, 1887, and July 28, 1890.

Opinions are not arguments, but I will say in conclusion that I believe that by a united and wise effort on the part of all her gas companies, such a law could be framed and enacted in Ohio as would reduce to a minimum the danger that constitutes by far the most formidable argument against a gas commission, namely, the possibility of a dishonest or inefficient board; and that with this danger practically out of way, or at least very remote, as it would be, a brief enumeration of some of the advantages of a commission would be.

1. It would constitute an intelligent bureau, to which the public could go for facts not readily accepted by them when given out by the gas companies themselves.

2. It would serve as a board of arbitration, who would be fully prepared at all times to decide, impartially and intelligently, any differences which gas companies and their municipalities or consumers could not satisfactorily and amicably adjust between themselves.

3. It would entirely remove the danger, to both company and consumer, of rading or competing companies.

4. It would tend very strongly to prevent petty and hostile legislation affecting gas interests.

5. It would do much towards checking the heresy of municipal control.

6. It would bring about a uniform system of gas companies' accounts, which would be worth to the gas companies much more than the cost and trouble of adopting and following the system.

7. It would cost the gas companies less to maintain the commission than the increase in the value of their stocks would amount to.

8. It would enable gas companies to feel safe in reducing the price of gas, thereby not only benefiting the consumer, but strengthening their own position in the field of artificial illumination.

Discussion.

Mr. Wilkiemeyer—The paper is certainly a most complete one, and the arguments advanced are explained fully; but yet the subject is one that can scarcely be discussed properly without first reading the paper half a dozen times. A remark was made last year by a member of the Association that a cloud had formed, at that time was very small—no larger than a man's hand—but now we see that it is growing, and we know that it will continue to grow from day to day. We want to protect ourselves; and we know that the people want nothing but what is fair. Of course, as Mr. Butterworth says, they have to be educated up to that point; but we can only educate them when everything is quiet. When a disturbance comes up in a town or city against the gas company, then is the wrong time to educate the people. You can not do it then; you cannot reason with them then. We certainly ought to come to some conclusion as to just what we want, or do need; and we can only do that in times of peace. We cannot do it in a time of war.

Mr. Cantine—We have with us Mr. Barker, of the Massachusetts Gas Commission, who can probably give us more light on that subject than anyone else.

The President—I can assure you, Mr. Barker, the gentlemen present would take very great pleasure in listening to any remarks that you may make on the subject of Gas Commissions.

Mr. Barker—As this paper was not put in my hands until the author began to read it, I have had no more opportunity to examine it than any other member of the Association. The subject, of course, is a large one, and of the highest importance, as it seems to me, to the interests concerned; not, however, more important to them than to the public, since the consumers and the companies have many interests in common. You will not be surprised to hear me state it that way, but it is a view which I have been led to adopt from a somewhat careful study of the business and its relations with the public, made without any particularly favorable bias toward the companies. Two or three ideas put forward in the paper perhaps might properly call for suggestions from me. One is with reference to the quality of any commission which might be appointed in the State—as to the character of the men who might compose it, their integrity, and their disposition toward the public and the companies. In considering this, there seems sometimes a failure to fully appreciate the fact that the possession of large powers will tend, as a rule, to make any man conservative and considerate of the interests which are under his administration. If you have a Board which consists, we will say, of no more than three members (which is the number in the Massachusetts Commission), the power vested in each member is great, and the responsibility of each is immediate. For these reasons I think a Commission is not likely to be either corrupt or rash. As an illustration in our recent history, I may give you an instance of what I mean. You may be aware that one of the duties of the Board consists in the exercise of the right to fix a price, upon the application or petition of consumers so to do. There has been an application of that kind pending in the Board now for some months—that is, it has been four months, I think, since the hearing upon it was concluded—and although the Board has given the question much study, it has not been able, in the press of numerous other duties, to consider it sufficiently to justify a decision in favor of either of the parties interested. It is possible that the City Council, in the particular locality to which I refer, would have been able to decide the question a

long time ago. They have no particular individual responsibility about it; they are a body, we will say, of 24 men, and the responsibility cannot be so immediate, nor so clear, as in the case of a Board of only three, where there can be no evasion of responsibility, where it rests equally upon every member, and where each must answer for the justness of his action to the general public as well as to the parties representing the particular interest concerned. The eighth brief paragraph at the close of the paper read by Mr. Butterworth describes, it seems to me, very adequately, what would be the advantages in any State of a board similar to the one in Massachusetts; and the paper states quite well, I think, substantially the benefits that have actually been derived by the companies in our own State from the existence of the Commission. On behalf of the public, it is a fact that since the establishment of the Board the price of gas has been steadily, I might say rapidly, reduced. Every year we have had a considerable list of companies that have reduced their price, until the year just passed, when the complications in the coal market have made companies hesitate in that direction. As I have said, this question is so large a one that I do not think I am prepared to discuss it. If there are any inquiries that I can answer I shall be very glad to do so. With reference to the form of an Act, you are probably aware that the compilation included in this paper is a condensation of all the legislation in Massachusetts pertaining to the Commission, and that legislation has been a matter of growth. The original act was not nearly as comprehensive, and did not give the Board anything like so great a jurisdiction, and I imagine was by no means in the shape, when it became a law, that the companies originally intended. For some four or five years, and I do not know but that for more, the interests in Massachusetts have been endeavoring to have the legislature pass some kind of a law, and had a definite proposition which they desired to have accepted; but when the act finally passed it was in a somewhat different shape. There were compensating features in it. The public surrendered to the companies very much; and it on the other hand asked that the companies should surrender something to it. So there is vested in the Board, on the one hand on behalf of the public, the authority to reduce rates under proper restrictions, and to compel a supply. On the other hand, in behalf of the companies, there is vested in the Board practically the authority to make unreasonable and unnecessary competition impossible. The Board has been called upon to act in all these directions, more frequently, perhaps, with reference to electric lighting than to gas, but it has been called upon to act with reference to both kinds of lighting. I confess I am somewhat surprised at (and also appreciate), the information which this paper gives as obtained from the Massachusetts companies touching their opinion of the law and its administration during the past five or six years. I appreciate it as substantial evidence alike of the careful work of the Board and of a disposition on the part of the companies to be reasonable and fair. During the time named almost every authority which the Board is allowed under the act has been exercised in one or more instances. Although this authority is very large, the policy has been to exercise it with very great regard for all interests involved and somewhat conservative, so that whether a decision has required a reduction in price, or a supply of light, or the settlement of other differences between consumers and the company, in no case has the Board been *obliged* to issue any order. It did issue an order in a single case because it was thought possible that one of the parties might wish to carry the case to the courts, and in order to lay the foundation for such proceedings, if they were desired, a formal order was made. After a study of the situation, and a consultation with the representatives of a company, the suggestions of the Board have invariably commended themselves to the good judgment of the management and have been adopted. So that the administration under this act, which, as you read it, you will see contains ample provision for the enforcement of a formal decree, has been exercised only in the way which I have described. I am not prepared to say that the act is entirely perfect in its present shape. Certain points in the suggestions of Gen. Hickenlooper, although radically different from anything in the Massachusetts law, are deserving of very careful consideration. The adoption of the English method of a sliding scale of prices may be a very wise thing to adapt, in some way or other, to the situation in this country, particularly in Massachusetts, and it might be in Ohio. If the interests in Ohio should endeavor to obtain some legislation in this direction, it would hardly be expected that they would secure at once all that they desire; and they might obtain some things which they did not desire; that is, there might appear in the law something which they would think not very desirable, but you will remember, Mr. President, that such a law would be carefully considered, and studied by whatever Board should be selected to administer under it. And whatever weaknesses might exist in the original legislation, there would be a good chance of having them remedied through the suggestions and labors of the Board itself. When three men are to be selected from an entire community as large as Ohio, or as large as any of the States of the Union, it would seem to me that the chances would be in favor of getting men who would view such a piece of legislation fairly and intelligently, and so whenever legislation may be had in any State (and I know that this matter is being considered in several), it is not wise to be discouraged because of the inability to get it in just the best shape at once. It must be a matter of growth, I believe—a matter of education on the part of the legislature—and as they come gradually to a full understanding of the situation, they will be able to act with greater fairness and intelligence.

Mr. Cantine—I would like to ask Mr. Barker a few questions. Has this Massachusetts Board discretionary power in the matter of contracts between a city and a gas company, or between any individual and a gas company; and whether the decision of the Board would be final, whatever that decision might be, after hearing all the facts in the case from both sides? Further, I see that all his remarks tend to favor a reduction in the price of gas. Suppose that after a time we use nature's supply pretty freely as they have done in Pennsylvania, and our supplies of coal from Pennsylvania and West Virginia are found to be diminishing, and the price increasing, would the Board give us just the same show of fairness as it now does the consumer? If our supplies were to increase in price in the ratio of 10, 20, or even 50 per cent., would the Commission of Massachusetts, or would a Commission in Ohio, gotten up on the same plan, do just as fairly by the gas companies as they want the gas companies to do by their patrons? That is a question I would like answered. If we had a Commission that would be as elastic in its operations as that, I do not see why we should have any fears from it. At present we have a much worse element to deal with, for we have 5, 10, or 25 councilmen (depending upon the size of the city), many of whom, having given the subject no thought, would scarcely know a gas works from a blast furnace, might not give us exactly the fair thing. We may not always be willing to do what is fair ourselves—we may be as faulty as they; but when we come in contact with a body acting in what they claim to be, or ought to be, a judicial capacity, we should expect to have fair treatment.

Mr. Barker—In reply to the first inquiry, as to whether the decision of the Board in such controversies as he describes would be final, I answer, yes. I think that provision is included in the law in terms. I do not see the particular section in this compilation where it is so stated, but it is safe to answer that question in the affirmative, with this qualification and explanation. I have no doubt the common law would declare that any price fixed by the Board must be a reasonable price. I have no doubt that a company could protect itself through the courts against a price that was unreasonable, oppressive, or impossible. While the action of the Board is final, and its determinations are practically conclusive as to matters of fact, yet it is bound by the law that its proceedings shall be regular, and that it shall act strictly within the authority that the statute gives to it. If it fails to do that, its proceedings may be reviewed, upon application to the Supreme Court of the State. No such course has ever been taken during the history of the Board, but it unquestionably lies within the power of the companies. The fact is, of course, that any such Board must have the support of reasonable and sensible men—of the reasonable portion of the community; and they must do what commends itself to the judgment of reasonable and sensible men. In this country no other scheme of government can stand, and it applies just as truly to a board similar to the one described as it does to any other method governing the whole people, or any portion of them. The theory of the Board has been that the best form of government is where the people feel themselves to be coerced the least—that is, where they feel the weight of the government least. The results that are to be secured by the Board should be obtained with this principle in mind. With reference to whether there is any provision for increasing the price, or any provision for reviewing the action of the Board, by the Board itself, or otherwise, I may say provision for that is to be found in Section 28, on the tenth page of this paper. That is an illustration of the growth of the law. That particular piece of legislation was adopted upon the suggestion of the Board itself. Being obliged to pass upon the question of price, and that question being of vital concern to the companies, it was thought some facility should be afforded, if a mistake were made, for correcting that mistake subsequently by the Board itself; and so, upon their suggestion, a scheme was devised by which, if a price is fixed to-day, and afterwards there is a change in the conditions, a year hence, six months hence, or five years hence, by reason of which change the cost of making and distributing the product is largely advanced, then the company may apply to have the price again fixed by the Board. As to a dispute between a

city or the local authorities and a gas company—a very striking illustration of the work of the Board, with reference to a situation of that kind, is shown by the Worcester case, mentioned in one of the earlier reports of the Board. A quarrel of long standing between the Company and the municipality, had reached a point where the city declined to pay any more money, and the Company had received nothing from the city, I think, for more than six months, the city declining to pay above a certain sum. In fact, the claim was made that under the charter of the Company itself, it was bound to supply gas at 50 cents per 1,000 feet; and although they did not insist upon that price, they thought they were making an extremely fair compromise when they offered to pay something like $1 or $1.25. The price asked by the Company was $1.80, and agreement upon a less price seemed impossible. Finding themselves unable to adjust the matter, an application came to the Board, and, after a consideration of the entire case, a recommendation was made by the Board—not an order, but a recommendation—that the price of gas be fixed at $1.50. Within 24 hours thereafter the Board of Directors of the Company met and voted to accept the recommendation, the city also readily acceded to it. As soon as the bills could be properly approved they were paid at that price, and the whole question settled itself very speedily. I speak of that simply as an illustration on the line of inquiry suggested by Mr. Cantine.

Mr. McIlhenny—I would like to ask Mr. Barker one question. This is something I have been watching for some time, and I may say, too, that I have been in favor of it. One provision of the Massachusetts law requires each company to give an account to the Commission of its business. That requirement seems, in the inception of this movement, to be the greatest objection to the Commission itself. I would like to ask Mr. Barker, for the benefit of the members, how that requirement is working now—whether the companies still object to rendering such accounts, and if there is any trouble in getting them. Do the companies feel that it is any injury to them to expose their business in that way?

Mr. Barker—We have never had any trouble with the gas companies with reference to the filing of their accounts, nor with the electric companexcept in the case of both kinds of business, where certain small companies failed to understand the scheme of accounts required by law. I do not recall to-day any company in the State but what makes its return readily and with very great completeness. I have not heard any criticism upon that feature of the law, I think, for the last three years. The matter of how much shall be published is left very much to the discretion of the Board; and the question of exhibiting the returns which the companies file, to every one who may call, is also a matter very largely within its discretion. The Board has held that it was not obliged to exhibit the returns of the different companies to everybody who might call at the office. We think we are warranted by the law itself in taking that position. The Board has selected from the returns, and compiled in the reports, such information as it believes is of value to the companies and to the public. The reports include, among other things, balance sheets of all the companies, in considerable detail. When the proposition to put them in the reports was first made it met with very strenuous opposition from a few of the companies; but I have heard nothing from it for two or three years. I think the companies which at that time objected have failed to experience the ill effects which they imagined would come. The fact is, while the public is exceedingly anxious at times to get at these facts, or at many of them, if they really know that they have them when they wish, they do not seem to care so much about them. I think that is true; and, therefore, such publication does not bring the disastrous results which certain people thought were threatened.

Mr. Cantine—It seems to me we could improve a little on the Massachusetts idea in one respect, if we are going to have a law, and that would be we would leave out this inquisitorial feature. There are very few people, either individually or collectively, who care very much to expose their business affairs to the public. If they are losing money they want to hide it. If they are making money, it would excite envy and jealousy from their neighbors, and it would do no good to let them find out the fact. A Frenchman, who visited this country before the war, while making a trip down the Mississippi river, said this was the strangest country he had ever seen or read of—the government was so mild that you could neither see it nor feel it. That is the kind of government we like here best. The more you put on the statute books in the way of superfluous laws, the worse for all kinds of business. Now, competition puts us in pretty good shape anyway. Our own selfish interests do that. I see from Mr. Barker's remarks no particular good in that part of it—in publishing the reports, making out balance sheets, and so on. If we were making out one we might be somewhat clumsy and might get the balance the wrong way! We would want it to appear all right; and it would oftentimes injure the sale of our stocks or bonds (if we saw fit to have any bonded indebtedness). I think the public have no more right to know the business of a gas company, with respect to their inner workings, than they have of a milling company, or of a grocery. Each individual outside of this business, with the exception of the three industries that supply the public with water, electric light and gas, is not obliged to let any one else know what he is doing. You may start an iron establishment here, and you say that Ohio does not want to know and asks no questions how much money you are making or how much you are losing. The State wants nothing to do with it. The State does not go into the business of regulating such companies; if it did there would be no end of it. It might go on *ad infinitum*. I should protest earnestly against that feature of the law. I think it would be disastrous to the companies and that it would discourage capital from going into those industries. I always objected to the income tax more than any other—not that I had very much income to pay on, but I did not care to let my neighbor know about my business. If I told the truth he would know too much; if I did not, I would be a perjurer. That was a serious objection to the income tax. The poor people, the mass, the mob, it seems, would like to have every capitalist taxed on his income—for what particular reason I never knew, more than that they would like to burden the fellow pretty heavily who has much for the benefit of those who have little. I think that is rather a bad policy in a free government, as we boast ours to be.

Mr. Harbison—As the subject of this paper alludes specially to Ohio, perhaps it is not in good taste for a man from Connecticut to have anything to say about it, but should rather let the members from Ohio, who are to be directly benefited or injured by the proposed legislation, decide the question for themselves. If I were in trouble and wanted an advocate, I do not know where I would think of looking in preference to the author of this paper, for he would make an admirable one. He has treated this subject in a masterly manner—from his standpoint—of course, I cannot help assuming, from the subject matter of the paper, that he is in favor of gas commissions for Ohio. From what has been said by our esteemed friend and honorary member, Mr. Barker, Massachusetts is to be congratulated; and the gas companies of Massachusetts are also to be congratulated in having such a man a member of their commission as Mr. Barker—a man in every sense of the word a gentleman, of conservative temperament, and in favor of justice in all cases. Massachusetts perhaps needed a gas commission (that was before the time when the leaven of Humphrey's came into it); it needed it much more than it does now; and that fact is evidenced by the interesting statement to which you have listened from Mr. Barker. Some gentlemen here present know that I have, in the American and Western Association meetings, opposed this matter, or have not favored the appointment of gas commissioners; but I did so because they were legislating for more than an individual State—the American Association taking in the whole continent, and the Western Association taking in a great portion of it—and I thought it would not be right for them to put themselves on record in favor of State commissions. This particular case I think is different, because you are talking about your own State. At a gathering of gas managers in the little State of Connecticut (small in acreage, but mighty otherwise), it was very nearly unanimously decided by an informal vote that we did not want a gas commission. There were only one or two who favored it—one was outspoken in favor of it, and a second one gave a partial assent to the idea. I have never been able to see in what way a gas commission would benefit the Company which I have the honor to represent. I have always believed that the Directors of our Company were as competent to manage our business in their own interest, and in the interest of the people whom they serve, as any board of gentlemen could be who were not as familiar with our peculiar conditions as we were ourselves. We have not found any obstacle at all, so far as the public were concerned, to our, at any time, reducing the price of gas. We have not yet known of a single case where any consumer has objected to the price of gas being reduced. We have that privilege and right absolutely as a Board of Direction; and we have exercised it very diligently. If we have resorted to the right which would be given us under such a law as this, that for every reduction of ten cents per thousand feet we could increase the dividend one per cent. (if we could earn the money to pay it), we would now be paying 34 per cent. per annum instead of 8—because we have reduced the price of gas $2.60 per thousand since the war; and, therefore, we would have 26 per cent. to add to the 8 per cent. that we are now paying, which would make 34 per cent. dividends that we could pay to-day to our stockholders, provided we could earn the money to do it with. We have not deemed it advisable to pay our stockholders so much money. We think 8 per cent. is pretty good. We pay the taxes for the stockholders, and they get that 8 per cent.

with religious regularity. I believe that the managers of that gas company can take care of the interests of that company thoroughly and well. I do not think that a company is doing its duty by its consumers if the citizens have to call on a commission to get them to compel the company to extend its mains, or supply them with gas, or to enlarge their mains, or to enlarge their works in order to give them a supply of gas. I think when a board of direction gets to that point the sooner they go to the happy hunting grounds the better it is for the community in which they live, for it is evident that they have mistaken their calling. The seventh reason given by Mr. Butterworth in favor of the establishment of a gas commission is: "It would cost the gas companies less to maintain the commission than the increase in the value of their stock would amount to." I do not apprehend that the maintenance of a commission is such an extravagant affair. They are not high livers, are not extravagant people, are men of very modest demeanor, and I do not think that their expenses are any more than those of the average citizen. I do not see how that helps the consumer. I do not see how an increase in the market value of stock is of benefit to consumers, unless all your consumers are stockholders. And that, by the way, is not at all a bad scheme if it can be carried out, for you seldom have any complaint from a stockholder about his bills. Mr. Butterworth's eighth proposition is that it would enable gas companies to feel safe in reducing the price of gas. I do not know why they are not quite as safe in reducing the price of gas without a commission to direct them to do so. We have the price down now to the average, ordinary consumer. The customer that burns a hundred feet of gas in a quarter gets it for 14 cents, if he pays the bill within five days after it is presented, and if he burns $500 worth in a quarter he gets it for $1.25 per 1,000 feet, and we have felt entirely safe in reducing the price to that rate. "Reducing the price of gas would not only benefit the consumer, but would strengthen the position of the company in the field of artificial illumination." That is a good point, but you should do it voluntarily. Do not let the public compel you to come to that point by an application to the public authorities. I believe in some cases it would work an injury to have detailed statements of accounts spread before the public. It would work an injury to our feelings perhaps as much as in any other way, in leading the public to think we had been trying to disguise the way we are doing business. In Connecticut they present an honest front to the public, so that they have no secrets in their business. I believe if that principle was lived up to carefully there would be very much less cause for legislation of any kind.

The President—I do not know that I have anything to offer in this matter. In reply to Mr. Cantine's question I would say, I have always thought it was right and proper for a gas company to make full and complete returns to a commission. I think it is right for the reason that gas companies, water companies, street car companies and the telegraph companies ask for general privileges. The man who runs a rolling mill, or a grocery, or dry goods store, does not ask for any such privileges. They simply ask to be kept protected from the mob and to have the right to walk on the highway. A gas company asks a right to use the streets almost to the exclusion of anybody else. If a gas company expects to get a fair judgment at the hands of a court (if it brings a case into court) or from a commission (if it is before a commission) it has to make a full exhibit. If no exibit is made, how can the gentlemen judge of the case any better than any one else could? If they had our or your individual accounts, or the individual accounts of any other gentleman, and had no other accounts to compare them with, they could not tell whether you were doing better than anybody else or not. When they have a full compilation of accounts from every company in the State, a statement of all the money they receive, how they had paid it out, what they paid it out for, etc., then they could arrive at an intelligent judgment of whether you were treating your patrons fairly or unfairly. If a company expects to get the protection that it would ask for under a commission, asking to have the State appoint a tribunal of gentlemen to hear its case, either from the side of the consumer, or from the opposite side, as a company, then that commission, in order to render an intelligent verdict, would have to be fully informed, if not from all over the State, certainly within the borders of the city they were going to act for.

Mr. Cantine—The point with me was that the power of this commission was simply ministerial and not judicial. Their decision is not final. An appeal would have to be taken from their decision to the courts, if either side were dissatisfied. All that you have got is simply their recommendation, either pro or con. They have not decided the question, as I understand Judge Barker, and that seems to be the trouble. There is not in any of these questions any necessity for going into a long litigation. If a commission is going to do its duty, then its decision should be final in all these questions where they are called upon to decide between the corporation and an individual, or between an individual and a company. That would seem to me to be an insuperable objection. Whether it be so or not I do not know. I do not claim to have very much wisdom in the matter. I only tell you how I see it, and not how it should be. I do not attempt to assert what it should be.

Mr. Barker—I do not wish to take any more time of the Association, or to discuss the general proposition involved in the matter now pending. However, I desire to make myself understood. I think the gentleman who last spoke did not understand me when I was upon my feet before. The duties of the board are more largely judicial than ministerial. When an appeal is taken from the board of aldermen, or from any other local authority, with reference to their decision as to the admission of a new company, the decision of the board in Massachusetts as to whether or not that company shall come into the field, is expressly declared by statute to be final. On all matters of fact, and on all matters of mixed law and fact which come before the board, the decision of the board is practically final. What I said with reference to an appeal was with respect to the regularity and legality of the action of the board—just as in the State of Massachusetts the action of a board of aldermen may be reviewed in a certain manner by the Supreme Court; and may be overruled when they have acted beyond their authority, or contrary to the law in any way. In that way, of course, the action of the board may be reviewed. But substantially their decision in all matters pending before them is final.

Mr. Strong—I doubt if the members of the Ohio Association have given this subject the attention which it deserves. I rise simply to confess our dereliction in this respect, and also to express satisfaction in the remarks of our Connecticut brother, and to say in confirmation of what he has stated that we have pursued, in two directions, the plan, first, in getting our people identified with us by being interested in our stock; and, next, in reducing the price of gas to a confessedly low figure. In those two directions we are occupying a position in our community that we never occupied before. I presume a great benefit might perhaps be derived from a commission of this kind in this State, in the protection against the danger mentioned in Section 3 of Mr. Butterworth's paper—dangers that companies are exposed to from raids. In this State I presume the statute is somewhat different from what it is in Massachusetts. Here, after consideration and approval by city council, it is submitted to the citizens, and it requires the majority of all votes cast at a special or general election to enable a competing company to operate. The security we have lies in the fact that our city councils are loth to give any consent to tearing up and necessarily damaging improved streets unless for very grave reasons. If a gas company will seek to make and keep friends at home by having its stock distributed and by making a good gas at a fair price, and follow all this up with courteous treatment and prompt attention to all details, little and big, the necessity of a State commission is not so apparent, and that a gas company so managed certainly does not need any protection.

Mr. Eugene Printz, of Zanesville, read his paper on

THE ALLEGED POPULAR PREJUDICE AGAINST GAS COMPANIES AND HOW BEST TO ERADICATE IT.

If there is a popular prejudice against gas companies, what is the cause of it? What would likely produce it? Is it not mismanagement by the directors, or by some of their employees, either the chief officers or some of their subordinates?

Owners or directors may issue orders, and insist on their being carried out to the letter, that many times are, to say the least, not likely to create the best of feeling, if they do not render the company unpopular. One individual director may be an unpopular citizen; the result will surely follow that any enterprise with which he is connected will be compelled to carry more or less of the odium. A great deal of the good or ill-will toward a gas company depends on the action of the secretary and superintendent; one or both of them may be addicted to intemperance; or, if not drinking men, they may not work in harmony. One may be of a surly, obstinate temperament, and not disposed to be courteous either to his fellow officer or to the company's customers. The overbearing and insulting manner of the office help many times is one of the leading causes for the unpopular feeling; the office employees not being willing to listen to complaints, treat the persons complaining with almost silent contempt. Careless, unmannerly meter-readers and impudent collectors are sources of much trouble. Poor gas or a lack of proper pressure may be the innocent cause of complaint at times.

Excessive dividends in proportion to actual value of plant is certain to produce ill-feeling and inaugurate the cry of "gas monopoly." In the early days of gas lighting one prime factor of the unpopular feeling (and that same feeling has, in a measure, descended to the present day) was the unwise idea of keeping everything connected with gas making a secret, in fact, a mystery; many so called gas-engineers endeavoring by every means in their power to educate the innocent public to believe that gas making was a most mysterious and almost a supernatural process. Well do I remember the stories told by the first stokers in the employ of the gas company of this city, which at that time was but a village! How the engineer in charge of the works insisted that the whole plant should be enclosed with a high brick wall in the front and a close, tight board fence around the balance, in order that the prying public could not by any means gain knowledge of how the light-giving "hydro carbons" were being produced! How he had one room under lock and key, where he alone was privileged to enter; in this room the final process of gas making was carried to completion, he only possessing the great secret!

The much-abused gas meter comes in for its share of the so-called unpopular feeling. It is beyond the comprehension of many how, as they express it, a simple tin box with a pipe for gas to enter on one side and the same for exit on the other, placed and connected down in the cellar that the gas may pass through—how can it measure? The thought to them is absurd. How can their minds

be disabused of this fallacy? Easily enough, if you go at it in the proper manner. You might say, show them a "glazed" meter in action, one in which all the working parts are exposed to view; but this would not be convincing or at all satisfactory. They would say at once: "This fancy painted machine has been gotten up for this purpose; that black box in my cellar is not a fine piece of mechanism like this one!" The better way to convince them that a meter is just as it is represented to be is to invite them to your work-shop and there see a meter which has been in service taken apart, piece by piece, that they may learn just how the meter is constructed and how it is enabled to do its work. Do not fail to show how the registering apparatus is to be adjusted to correct the meter should it run fast or slow, and if they should so request let them take the meter to their homes to study its beauties at their leisure.

There was a time (I am sorry to say) in the history of our home gas company, and that not many years ago, when there did exist a feeling of unpopularity against the company, engendered by one of the causes previously cited. By judicious management this ill feeling has passed away, and to-day there is no more popular business in the city than that represented by the gas interests. If there is any unpopularity it is only apparent, not real. What class of progressive citizens wish to see the gas works of the city shut up? The little unjust criticism there may be comes from those who have never paid a dollar for gas, but John Smith told them "he was away from home a month," etc.—the old story! Do we not *imagine*, without any reason for the thought, that our line of business is not popular? Every business has its own peculiarly unpleasant features. The dry goods merchant does not want his boy to go into that business. The doctor knows his is a dog's life. The gas man is no exception to the almost universal rule. Usually he has been in the business all his life, and thinks his the only business that has anything unpleasant about it, when the fact is he is remarkably free from the troubles that usually annoy the business man. Right here let me ask, did you ever know a man, who had been engaged in other lines of business, to embark in that of the manufacture and sale of gas who did not feel as though he would prefer it above all others?

One thousand gas bills can be collected with less growling than ten dry goods or grocery bills. Whether a man is making money or not his grocery bills run on nearly the same, but he can save gas when necessary.

How best to eradicate a prejudice, did it exist: Teach the people to read meters and to make approximate tests of the amount of gas burning, and how to detect the presence of leaks by the two-foot dial, so they may know they are getting what they pay for. The better informed the better the customer.

The superintendent is usually too busy to do much of this kind of work, but the secretary is the more valuable as he is capable of doing such work; and right here allow me to say, we do not think that the more important work of a secretary is in the office. Cheaper help can be obtained to do the book-keeping under his supervision.

To sell gas is just like selling any other commodity. What is the use of having a good thing unless people find it out? Every wholesale merchant has his drummers, and in this day of push almost every groceryman sends his salesman from house to house daily soliciting trade. So must the gas business be run, if you want to make it and keep it popular. Who is in as good position to do this work as the secretary? He sees a new house going up, no gas; he calls on the owner, tells him how little it will cost to put in the pipe, and how much it will add to the selling price of the house should he desire at some future time to place it on the market. Usually the pipe goes in. He calls on him again after the house is finished and the owner or tenant has moved in, persuades him to try gas a month; he puts on fixtures and tries it; of course he is surprised at the low cost. The secretary calls again, explains how, with a mixture, seven to eight parts air (which costs nothing), and a little gas, one part, which costs so little, the cooking can be so easily done, and no heat in the room. The gas stove goes in, and the first thing you know the neighbors want the same thing.

The gas men who come in contact with the company's customers should always carry tips, burners and cleaners to be given free on application It does not pay, neither is it advisable, to charge for them. Never fail to listen patiently and attend promptly to complaints, no matter how trivial in nature. Let your customer feel that you appreciate his trade and that you desire to keep it. Never grow weary of telling the good points of what you have to sell; teach and talk gas as economical, both for lighting and cooking purposes; at present prices it is no longer the luxury of the rich, but really the necessity for the rich and poor.

Consumers only remember the largest monthly bills, forgetting the summer ones entirely. If you should ask them what their gas costs for the year, they will more than likely multiply their December bill by twelve. To correct that idea in this city, we have adopted a rule of this kind: as soon after the holidays as possible we send to each consumer of gas a statement for the year, showing the amount paid monthly, the sum of all divided by twelve, thus showing the real average paid per month and the total amount for the year. Many of our patrons have expressed their surprise at the small outlay for gas lighting, and said, "had they been asked the question they would undoubtedly have named a sum fully two or three times as large." We find these circular statements very convenient for reference; many times, when soliciting a new customer, simply calling the attention of the proposed consumer to the yearly statement taken from the report of gas consumed in a dwelling similar to the one he is building.

To make our business popular, advertise in the newspapers. In a word, whatever method of doing business makes the popular merchant, the same manner of dealing will make the popular gas company; remembering that good deeds are thought of only for the day, but your mistakes are criticised and exaggerated by repetition, and remembered by the public for many days. Apparently large dividends will subject a lighting company to unjust criticism. A gas company should be allowed to pay a fair rate of interest (certainly not less than 8 per cent. per annum) on the actual money value of the plant. I do not mean "watered or bonded stocks," neither do I speak of low capitalization, but on the true value of the plant were it placed on the market for sale. In addition to this, considering the hazardous character of the manufacturing part of the business, the company should have a reserve fund of at least one-half the value of the plant, so as to be prepared at all times to meet the many serious accidents to which we are liable.

A gas company should not be rated as unpopular for conducting its business so as to produce the above results, and no fair minded man of business education would consider it as such.

In conclusion permit me to say, that to make the popular gas company, furnish good gas. Let the supply be ample, and at as low a price as is consistent in justice to your stockholders. See that correct business principles are applied by those coming in contact with your consumers.

The consumers should at all times be treated with firmness, but with the greatest courtesy and politeness. Attend strictly to your own line of business. Enter not into newspaper controversies, and ever bear in mind that the merchant of any popular business can make his business unpopular by complaining and continually crying that people are "down" on him; but he can do so no quicker nor more effectively than can the officers of a gas company, who think or say they have an unpopular business.

Discussion.

The President—You have just heard a paper read which is full of valuable suggestions, and it affords you a field for extended discussion.

Mr. Cantine—I think we owe Mr Printz a hearty vote of thanks for his excellent paper, which, without any desire to be irreverent, I may say, is almost equal to Christ's Sermon on the Mount. It is a help to us all, and will lead us all to try to do better hereafter. I move you that the thanks of the Association be given him. [Adopted.]

Mr. Graeff—I would like to ask if it is the idea to send to consumers at the close of the year a statement of their monthly consumption for the year? And whether that plan is followed out any where except in Zanesville? I think it is a very good idea.

Mr. Cantine—I think the Mansfield Gas Company does the same thing. Is that not so, Mr. Strong?

Mr. Strong—Yes, sir; and have done so for two or three years. It was brought about in consequence of the competition of an incandescent electric light company which furnished its light at a stated monthly price, and we found ourselves at disadvantage sometimes in the winter season. We put out a little "dodger," with blanks, which we filled with the consumer's name, and his year's consumption of gas and cost of same; in the case of an old consumer who had strayed, we took his last year of gas consumption and divided that by twelve, to show the cost per month, and suggested his division of this monthly average by the number of gas burners in his room would show the cost of gas per burner per month. We find exceedingly satisfactory results from this little "dodger," as it shows quickly how small the monthly cost of gas is, and that our gas, to say nothing of its superior candle power, is 40 to 60 per cent. cheaper than the incandescent; and it brought back to gas consumption nearly all who left us.

Mr. Faux—I can support the gentleman's statement, for I have had that same experience this winter. One man's bill for fuel gas for the month of November was $4.50, and for December $110. After that he had nothing to say about illuminating gas.

Mr. Harbison—I think you will find the same rule will work practically with the same results, if you can get an incandescent electric light company to sell their light by meter, and then compare bills. The complaints will all be removed from the gas company, and the other fellow will get the blessings.

Mr. Faux—We experience the same thing; and with natural gas sold by meter we are getting nearly all our customers back again.

Mr. McIlhenny—I consider Mr. Printz's suggestion with regard to sending out those monthly statements a very valuable one, and if done it would remove a vast amount of prejudice on the part of consumers. From my experience in the gas business, I found, as he stated, that people always take the largest monthly bill of the year, multiply it by twelve, and call that the gas bill for the year. If their largest bill happens to be $12, they will say that they burn $144 worth of gas per year. When they see this statement in black and white before them, and have the means in their own hands—the bills—of verifying it, they are convinced they have been doing an injustice to the gas company, and begin to feel that after all the gas company is not as bad as they thought it was. They will say less about it thereafter because they know they have been doing the company a great injustice.

Mr. Harbison—In connection with this matter, I want to make one point. Mr. Printz alludes to the abuse of the gas meter—it certainly does come in for its full share of the unpopular feeling—and says that "You might show them a 'glazed' meter in action, one in which all the working parts are exposed to view; but this would not be convincing or at all satisfactory. 'This fancy painted machine has been gotten up for this purpose; that black box in my cellar is not a fine piece of mechanism like this one.'" Eight or ten years ago the Trinity College buildings were put up in our city, and they wanted meters to put in the hallway of this building. As the hallway was very nicely finished, they wanted the meters to compare favorably with anything else in the building. We did not want any "black imps of the coal hole," as they were called by a distinguished New England brother at one time, but we wanted something which would not be out of place in a sitting-room or parlor, in its appearance. We bought a couple of dozen of three-light meters, painted a chocolate color, and with the front decorated with very neat stencilling. The two dozen were not sufficient, and we sent for two dozen more to be painted the same way, and they were sent. I thought they looked so well that it would not be a bad scheme to have all our meters finished in that style; and so, for a consideration that would not exceed one cent per year on the life of the meter, we have had all the meters that we have bought since that time painted a chocolate color, and decorated in front. I know the meter manufacturers will be very glad to receive your orders on those terms—it will not cost you over 25 cents additional per meter to have them finished in this style. Now, if you will let your meter man take two or three meters finished in that style (or old ones done over in that way), in his wagon, with half a dozen of the "black imps of the coal hole" also, go around and set both kinds of meters, and see how the impression made on the man who is going to have the black one will differ from that made on the man who is going to have the decorated one, he will see for himself the advantage of using the decorated one, although the black one may measure the gas just as accurately as will the decorated one. We have had now an experience of eight or ten years with those decorated meters, and we don't want any more of the black ones. The consumers say they want such a meter as John Smith has in his cellar; that, as his bills are all right, we want the same machine he has. Now, more than half of all the meters in Hartford are painted a chocolate color and decorated in front. There is no little effort that we have made that has tended so much to do away with the prejudice against the gas meter as sending out a meter which was painted and finished in this style. Not one complaint in twenty has been made against this meter compared with those made before we introduced it. Another point as to removing prejudice. You can very largely add to your illuminating power without much increase of cost—a practical reduction in price will be very satisfactory to your consumers, even if it costs you something to do it. Increase your illuminating power. See that your consumers have good burners, and furnish anything that they need—not by giving it to them, as brother Printz says, for I take issue with him on that point. I think they do not appreciate what they get for nothing. I would sell to them at cost anything they want; I would send a man two miles to put on a burner for a man, and charge him eight cents for the burner, nothing for labor. Another point: Talk up the gas stove trade everywhere. I am happy to say we are now in our place sending out 25 per cent. of our entire output between 7 o'clock in the morning and 5 o'clock in the afternoon, the year through; having 1900 gas stoves at work in our town. We have within the last six months, increased our illuminating power 23 per cent., which is a pretty handsome reduction in price, if you look at it in that way; and I do not know of a sore spot in the city with any customer. We do not permit that. If anybody comes into the office with a grievance, the clerks do not argue the question with him, but refer the case to the secretary or to myself, and we deal peaceably with him, or call on them at their convenience, when they don't feel half so bad about it. Incidental ways of that kind are very effectual in satisfying your consumers. A man comes into your office to-day in pretty nearly fighting trim; to-morrow his temperature has been wonderfully reduced. By the following day he is ready to talk with you like a neighbor and a gentleman, and he feels a little mortified that he lost his temper when he first saw you. Attention of that kind will go a great ways towards relieving the company of a great deal of ill-feeling and prejudice; and you will soon find the public with you, and the papers as well.

Mr. Nash—I would like to ask Mr. Harbison whether he sets a special meter for the gas used for heating and cooking purposes; or does it go through the same meter as the gas used for lighting?

Mr. Harbison—It goes through the same meter as for lighting, except where they are burning oil, or not using gas for illumination. We have set only about a dozen meters to supply 1900 stoves. We do not give a special rate.

The Secretary—Speaking of the relation of meters to the popular prejudice against gas companies, I am reminded that I had sent me lately, as a literary curiosity, a letter written to a meter manufacturing company by a man in El Paso, Texas, and I will read it:

"Gentlemen: A friendly discussion arose here a day or two since about the measurement of gas and water meters. An assertion was made that now a-days in small towns where they have no water or gas commissioners, that meters of double measurement were frequently imposed on the public—that is to say, when 100 feet of gas has been consumed the meter registers 200 feet as having been consumed; the same way with the water. Can you tell me whether or not such meters are placed on the market? I simply ask the question for my own information. I am not in the gas or water business, and never expect to be. If such meters are manufactured, I am not even desirous of knowing where nor by whom; but by giving me what information you can in regard to this matter you will oblige. Yours truly," etc.

Mr. Graeff—Has any gas company in Ohio, in competition with an electric lighting company, ever tried the experiment of furnishing gas just as the electric light company does its light, at so much per month?

Mr. Christian—I have had a little experience in that line—more than I wanted. I had rather pay for the meters and put them in. In our town we have had a competition, first, with the arc light and then with the incandescent. When the arc light came, we started to furnish gas on the same plan that they were doing; but in doing so we found we were at a great disadvantage, for the reason that the electric light company can shut off the electric current at a certain hour, but we cannot shut our gas off, but have to furnish it day and night. We found that the consumers would burn it in the day time when they did not need it. It worked very badly with us. We held a good deal of trade that we might have lost otherwise; and perhaps in the long run, if we could work it down and figure it out, we would find we had not lost any money by that plan. If you can get better prices, or fair prices, such as most arc light companies get for their arc lights, you can take contracts for stores at about the same prices and realize $1.25 per thousand feet for your gas—fully that much. But at the same time in many stores they will burn gas (because it costs nothing extra) in the daytime an hour or two earlier; and that is true especially in the winter time when they would otherwise put the arc light in at the same price. I think the fact of having the gas on in the day time is a good lever by which to hold the trade, if you place the price the same as the arc light. In our town the incandescent light is furnished at pretty low rates.

Mr. Graeff—I asked the question because I know of one town in Pennsylvania where that plan has been tried against an incandescent lighting company. The manager of that company who is a very careful man (known to all the eastern contingent here) states that he kept as careful a record as he could, and that he considers himself ahead upon that basis. I wished to know if anybody else had been trying it.

Mr. Clapp—I had some experience in that direction in competition with two electric light companies—the arc and incandescent. I found they went around in the winter time when the gas bills were largest, and contracted to furnish electric light at a very much lower price than gas was then costing the consumers, in fact at about one half the price. In that way they kept away some consumers, and took some from us—that was in the winter—but in the summer I would always gain. So I thought I would try the system and I contracted with about one dozen consumers. I found at the end of the year that if I had to furnish gas by contract I would get out of the business as soon as possible. But the result in the end was that I knocked the electric light out entirely. It was only a question of time. I think a gas company can contract to furnish light very much cheaper than electric light is furnished; but, as has been said, the consumer will burn it all day; and so I do not think that any gas company could exist for a long time, if furnishing gas on the contract system.

On motion of Mr. Wilkiemeyer a vote of thanks was passed to Mr. George R. Clements, who presented the Association with a handsome basket of flowers.

Appointing two Special Committees.

The President—While the next paper is being distributed I wil announce two committees:

On Nomination of Officers.—Messrs. Eugene Printz, L. A Strong and W. W. Prichard.

On Place of Meeting.—W. W. Cantine, G. H. Christian, Jr., and C. H. Welch.

Mr. A. P. Lathrop read his paper on

THE DESIRABILITY OF A UNIFORM SYSTEM OF GAS COMPANIES' ACCOUNTS.

As there is so little competition between illuminating gas companies, it would seem as if any information which one company should offer to another would be not only of benefit to the fraternity at large, but would have also a retro-active effect upon the one suggesting it, consequent upon the interchange of ideas.

We have, at different times, had papers read touching almost every branch of our business, but the work connected with the office has received but little attention.

As this is the place where results are determined, it is evident that some uniform system of arriving at the same would be conducive of much good. We frequently hear of one man being able to put gas into his holders at an extremely low price, while another man, similarly situated, perhaps recognized as an expert gas engineer, cannot approach the other's figures. Probably, could we examine the matter closely, we should find the results obtained by the latter equally good, but the method of arriving at them at wide variance.

As we do not have time to stop and figure, it seems as if it would be good policy on our part to adopt some plan by which we could make comparisons at a glance, and which would discover at once the points wherein we are weak and others strong.

None, probably, have a perfect system, yet all, no doubt, have a great many very good points, peculiar to their manner of keeping accounts, which could be incorporated into a general system, at once simple and comprehensive.

Some companies may prefer to go more into detail than others, but a general plan could be arranged which would suit works of any size.

I will attempt no suggestion as to a system of keeping accounts, more than to say that the form established by the Massachusetts Gas Commission, the one now used by most English companies and the form devised by the committee from the Western Gas Association, all appear to be concise and in every way satisfactory methods of showing results.

Were uniformity established and reports upon this basis exchanged, that comparisons might be made, would it not be an incentive to put forth extra efforts to excel, or at least cause more careful attention to be given points showing unsatisfactory results?

Before taking definite action, however, it might be well to ascertain the readiness of the companies throughout the State to adopt such a system as herein proposed, and I would suggest that the Secretary be authorized to communicate with them to learn the feeling regarding the adoption of such measures, and their willingness to exchange reports gotten up according to a plan which may be recommended by a committee appointed by this Association.

Discussion.

The President—The subject of the paper just read by Mr. Lathrop is one in which a few members of this Association have felt a very lively interest. The work outlined by Mr. Lathrop is a work that would receive hearty co-operation on the part of a few members of the Ohio Association; but the co operation of only a very few is not what is desired. The desire of the few is to get others to co-operate with them in order that we may have a general system of accounts. The subject is one that you have no doubt all thought of, and we would like to get a general expression of the sense of this Association on the desirability of adopting a more uniform method of keeping gas accounts in the State of Ohio.

Mr. Harbison—The subject is well treated in the paper, which contains very practical suggestions. Situated as you are here in Ohio, although a good, large State, yet you are practically making gas under the same conditions, and to be able to make comparative examinations of working results is an exceedingly valuable thing to every gas manager. One of the greatest difficulties which beset a manager is to have a brother gas engineer ask him, "What does your gas cost you in the holder?" You hesitate about answering, because you have one way of figuring up the cost of gas in the holder, and very likely your neighbor has a different way. If you say it costs you 30 cents per 1,000 feet in the holder, another man may say it costs him 25, and so on. You do not know what he has figured in as the items of cost—you have tried to get at your own cost honestly—and the result at the end of the year, on a comparison of results, is that you may be "left." Now, if as an Association, you can agree here in your own State on a system of figuring up your manufacturing accounts, I think you will find, no matter how small your works may be, it will be of exceeding great value and interest. Your neighbor twenty-five miles away is putting gas in the holder at two or three cents per thousand feet less than you, and you will inquire how it is done. You will want to find out the details, you will try to find out how he can save two or three cents per thousand, and you will go home and try to equal him. Or, if you are beating him, he will visit you and try to find out your details. Thus there is an incentive to more thorough work and to more careful looking after details. I would, therefore, earnestly advise this Association to adopt a uniform system of accounts and then try to live up to them, which will not be simply for the benefit of a few larger companies, but of greater benefit to the smaller ones.

Mr. Welch—I do not see how the importance of this matter can be put any stronger than in the remarks made by Mr. Harbison. It is a question that in some respects is kindred to the commission question. In the event of a commission being provided for in the State of Ohio, the adoption of some universal system of that kind would become a necessity; it could not be carried on without. And as for a system of that kind being adopted voluntarily by all the companies, it is clearly to their advantage to do so if it serves the useful purposes stated by Mr. Harbison. I see no reason why the Secretary should not be instructed to make those inquiries, or why we should not put the matter into the hands of a committee.

Mr. Cantine—It seems a very easy matter to get that in proper shape so that the accounts would be kept uniformly. I suggest the propriety of the Chair appointing a committee of three or five persons, taking Mr. Lathrop as Chairman (for he thoroughly understands the matter), to devise a form embracing certain materials and items which shall go into the manufacture of gas in the holder. After that form is so approved by the Association, let it be adopted by each individual gas manager in Ohio. Then there would be only one question in the matter of differences in cost of gas in the holder—the difference in the cost of transportation, and possibly a difference in the labor account, as in some cities and towns labor is more difficult to obtain than in others, and in some places higher salaries are paid. Let the salaries of the stokers be stated in each case, and then in comparison it would appear what is required to pay the men. Also, let the rate of freight be stated. In that way you would get an exact uniformity as to the manner in which the resulting figures would be arrived at.

Mr. McCook—In order to get the sense of the meeting, I move the question be put that all those in favor of a uniform system of accounts express their assent, and then a committee can be afterwards appointed.

Mr. Tayler—Before the question is put, and so that I can vote intelligently, I would like to ask whether the Western Association is still working on a uniform system of accounts. If the Western Association is going to adopt a system I do not think we want to adopt another. We had better wait and learn what their plan is.

The President—The Western Association considered the subject at their last meeting in connection with a report presented by Mr. George G. Ramsdell, and it was ordered that the Secretary draw up forms of accounts, following out the line laid down by Mr. Ramsdell. Those forms are to be submitted to the members of the Association during the year for their adoption, approval, or amendments, and they will come to the next meeting of that Association prepared to discuss the whole subject. The importance of this matter has been appreciated by a great many members of the different Associations, but there has not yet been expressed a willingness on the part of many to incorporate the system. Some claim that the amount of labor involved in subdividing the accounts and in carrying out the details would require so much work that they would not care to undertake it. It has been moved and seconded, as I understand the motion, as many as are in favor of adopting some uniform method of accounts (and, of course, with the understanding that such members will incorporate the method in their business), will signify it by rising. The motion prevailed unanimously.

Mr. Cantine—I move the Chair appoint a committee of three persons to revise this form; that the form be made as simple as possible; that there be nothing intricate about it; but that it should be so plain that any man who does not pretend to be a bookkeeper or accountant can very easily comprehend it; that the form shall be comprehensive, and yet not so far reaching that it will mystify anybody, like the census reports.

Mr. Harbison—Permit me to suggest that the committee be directed by your Association to confer with the committee appointed by the Western Association, so that the difficulty which has been referred to may be obviated, and that we may not have too many systems of accounts. If the Ohio, the Western and the American Associations can agree upon one general system, by means of the committees of the Associations conferring together, then each brother will have but one system of accounts, and that system will be good in Ohio, Connecticut, California, or in any other State. Therefore, I would suggest that your committee confer with the committees of the Western and American Associations, and that the three committees acting together formulate a simple plan.

The President—It is moved that a committee of three be appointed, with instructions to confer with the committees of the other Associations, and to report back to this Association, at its next annual meeting, a form of accounts conforming with the plan adopted by the other Associations, so that the form that we will have hereafter shall be of national character instead of an Ohio character, and that that form be submitted in the nature of a report at the next annual meeting. [Adopted.]

(On motion, the thanks of the Association were tendered to Mr. Lathrop.)

The Association adjourned to Thursday, March 19, at 9 A. M.

SECOND DAY.—MORNING SESSION.

The Association was called to order at 9 A. M. The President called for reports from special committees.

Report of Committee on Place of Meeting.

Mr. Cantine—As chairman of the committee to select the next place of meeting I report the propriety of going to Columbus next year. We have a cordial invitation from the representatives of the gas company there, and it seems to me that Columbus is the place best suited for the meeting, because of its central location. The committee are unanimously in favor of meeting at Columbus.

(On motion the report was accepted and the recommendation was adopted.)

The Secretary—I want to say that the Association is cordially invited, on behalf of the Columbus Gas Light and Coke Company, to meet in Columbus, and we will try to take care of you satisfactorily. We shall have a new hotel a year hence, and it will be within a square of the gas works.

Report of Committee on President's Address.

Mr. Graeff—The committee on the President's address submit the following report:

Your committee appointed to consider the recommendations made in the annual address of your president respectfully suggests:

That the appointment of a committee on World's Fair be made in accordance with the recommendation in the address:

That the Secretary be instructed to make a proper minute in the records of the proceedings of this convention, referring to the death of our lamented fellow member, Professor S. H. Douglas, and that a copy of said minute be forwarded to the family of the deceased.

(On motion the report was accepted, and the recommendations adopted.)

JOINT COMMITTEE ON UNIFORMITY IN GAS ACCOUNTS.

The President—I will name, as the committee appointed to confer with the Western and American Associations in the matter of a uniform system of gas accounts, Messrs. A. P. Lathrop, of Columbus; G. A. Allen, Zanesville; and George W. McCook, Steubenville.

On motion of Mr. Cantine, C. R. Faben, Jr., was also appointed as a member of the committee.

Mr. Frederick H. Shelton (Phil., Pa.), read his paper on

A CONSIDERATION OF THE ARGUMENTS FOR AND AGAINST WATER GAS.

Mr President and Members of the Ohio Gas Light Association:

Gentlemen—At the last meeting of this Association a paper upon "The Advantages of a Combined Coal and Water Gas Plant" was read to you by Mr. George Light, of Dayton, Ohio, and a somewhat surprising discussion ensued—not of the advantages of such a combination, but of water gas in general. The paper itself was eulogistic of water gas to a high degree, but the discussion following was so interspersed with misleading opinions of what could and could not be done in its manufacture that an extremely wrong impression could be formed from it.

For instance, one member seemed to think that half hour runs were proper; another, that water gas was much harder on meters than coal gas; another, that as high a candle power gas could not be made with coke as with coal. One said that water gas cost more than coal gas in the holder; another, that "we can make it a great deal cheaper;" and several seemed to think that greater trouble is experienced from naphthaline in making water gas than in making coal gas. To one familiar with the progress made during the past few years the above ideas, finding expression at this date, are, as I said, rather surprising. An explanation of it, however, is readily to be found, and is simple, namely, each member, of course, could relate but his own experience, and where that happened, through some fault of apparatus or management, to have been unfortunate or unusual, the listener was not in a position to hear the other side of the story or the real facts that would apply to the majority of cases, unless some other member had had an opposite experience, and also related it.

In other words, some bad workings were described, and but few of the good points of water gas happened to have been spoken of that would more fairly balance the impression that would be left on the mind of a listener.

I take it that in this Association the members desire to be not especially coal gas engineers, nor water gas engineers, but gas engineers, and that the truth about every kind of gas is desired, let it hit where it may. I take it also that this Association is broad enough to desire all knowledge possible from any attainable source. This being so, I, residing out of your immediate boundaries, and hence able to glean some facts of interest from sources that you, perhaps, are less apt to come in contact with, ask that you will accept those that I am about to give as a simple contribution to our common stock of knowledge.

It has been my good fortune to have been associated with those who have led both in the construction and in the operation of water gas apparatus and works. In such connection I have had to travel in nearly all parts of the country, and have so had the opportunity, the benefit, and the pleasure of seeing a very great number of such plants, old and new, large and small, well and poorly operated, and of nearly all the "processes" that have been put upon the market. I have watched with great interest the wonderful growth of water gas, and the steady living down, one by one, of the objections that were formerly urged against it. The great majority of these objections, many of which unfortunately were valid when made against the early forms of apparatus and the poor quality of gas made therein, no longer hold good, in view of the apparatus and the gas now made; and in addition the good points of the water gas system of manufacture are daily, and more and more emphasized, as competition in the furnishing of light and the demands of the public become more exacting. Perhaps the most striking thing to me as I look over the field is the great number of different forms of apparatus that have been evolved—good, bad, and indifferent. To choose from amongst them is like selecting a gun. One may buy a five-dollar musket (which neither you should use nor the public cares to have you), or one can get a fine breechloader. The simile is a good one, I think, for water gas plants. One can get a cheap apparatus which (having no merit but cheapness), like the musket, fouls soon, is hard to clean, laborious to operate, is absolutely unsafe, does its work but poorly, and is soon condemned as unsatisfactory; or one can buy a good water gas apparatus, which, like a fine breechloader, is well balanced and proportioned, is easily handled, is safe to operate, does its work well, and is kept in active and satisfactory use.

In this paper, upon what is now being done in water gas, I have the latter kind of a plant only in consideration. I am not dealing with cupolas, making lamp black and tar, with gas as a by-product, nor with old forms that are so proportioned that they cannot fix the gas, but must perforce send out a vaporized oil diluted with hydrogen gas. I am dealing with *a good, well made, properly-fixed water gas, made in modern and properly-proportioned apparatus.* Kindly bear that in mind. I have no time to here go into the history of it, interesting as it is, nor desire to describe to you any particular form of apparatus, but taking the subject as a whole, I wish, first, to review the arguments that were formerly made against it, showing how they have either one by one disappeared or else how much weight should be justly attached to each; and, second, to enumerate the points that time has shown are distinct arguments in favor of the manufacture of water gas.

OBJECTIONS MADE AGAINST WATER GAS.

"*Water gas has no odor*, therefore is dangerous, as people can be unconsciously asphyxiated by it."—This claim was so soon exploded that to dwell upon it is unnecessary. It came from the fact that a non illuminating, "blue," or fuel water gas has but little odor, and opponents of water gas willfully confused the two gases and tried to convey the impression that this gas and illuminating water gas were one and the same thing.

Every gas man knows that the moment a drop of oil is added to water gas, to give it illuminating qualities, the product is made odorous, and that carbureted or illuminating water gas, as here considered and generally spoken of, has an odor similar to and quite as strong and pronounced as coal gas.

"*Water gas is heavier than air*, hence in case of leak, instead of rising, it sinks—therefore is dangerous from its liability to asphyxiate people."—This is another old claim on a par with the preceding, in its total variance with the facts. After several balloons were filled with water gas and calmly floated away, the groundlessness of it was seen.

As a matter of fact, water gas varies (according to the process of manufacture and the richness of the gas) from but one-half to seven-tenths of the weight of air. The following table of densities I have collected from numerous printed matter and authorities, air being taken as a standard at 1.000:—

Table of Specific Gravities of Various Illuminating Water Gases.

Process.	Place.	Candle Power	Specific Gravity	Authority.	Year.
Lowe	Utica	19.5	.571	Wurtz	1875.
Springer	Chicago	20.	.6302	Wheeler	1886.
Lowe	Baltimore	22.5	.5885	Wurtz	1880.
Granger	Worcester	22.06	.5915	Moore	1885.
McKay	Titusville	24.	.600 to .670	Salathe	1885.
Tessie du Motay	New York	24.35	.590	Gas Examiner of New York	1885.
"	"	25.37	.633 to .643	" "	1983.
Granger	Lake	26.31	.6018	Moore	1885.
Wilkinson	New York	28.31	.696 to .712	Gas Examiner of New York	1883.
Tessie du Motay	"	29.57	.643 to .659	" "	1883.
"	"	30.	.652	" "	1889.
Wilkinson	"	30.19	.713	" "	1889.
Jerzmanowski	"	30.75	.718	" "	1889.
Lowe	Kansas City	31.90	.7071	Harper	1891.

This table shows plainly the gradual increase in the density of water gas, as more oil is used in its manufacture, to increase the heavy hydro-carbons or illuminants necessary for the higher candle powers. Roughly speaking, therefore, 20 to 24 candle water gas is in density from .600 to .650, while those who find it policy to put out a very high candle power, say 28 or 30, must expect a density of about .700.

"*Water gas stratifies*, therefore it is irregular in quality at the

burner."—This is another old allegation which I should regret having to undertake to prove, for I do not think it can be shown to ever have been a fact. The only conditions that I can think of which would give any basis for the claim are these: Assume an old form of apparatus, making, say, half-hour runs, and the gas, therefore, very different in quality at the end from the beginning of a run. Next, a small holder, so that no great quantity can there accumulate, and the gas is so made practically right on the town, and that it is taken as fast as made. I can see under such conditions how a gas of varying quality might be delivered at the burner. But that is not "stratification;" it is exceptionally poor running and conditions.

Under present practice of apparatus and operation the runs are kept very short, and the gas, made on the cream of the heat, so to speak, varies but slightly in quality. But even this slight variation in the product in this stage of its manufacture cannot help but even itself up *by diffusion* in the holder, if it is passed into such at all, as it necessarily must be. Dr. Moore states: "All gases diffuse through each other as they do in a vacuum, and however hetereogeneous may be the constituents of any given mixture of gases, they become diffused to a perfectly uniform mixture in an exceedingly brief interval of time." The proof of the pudding is in the eating. Modern water gas companies maintain quite as uniform a candle power as do coal gas companies, and constructing companies stand ready to guarantee, if necessary, with either cupola or retort type apparatus, that there shall not be a variation of more than half a candle power from a given standard at the outlet of one's holder.

"*Water gas is more dangerous to use than coal gas.*"—This claim is based on the fact of there being a greater amount of carbonic oxide in it than in coal gas. I do not propose to waste much time in going into detail of this old question. It has already been tried and a favorable verdict given by the gas world of the United States, and is now back history.

Every one knows that coal gas contains from 5 to 10 per cent., and water gas from 20 to 30 per cent. of carbonic oxide, according to the particular process and circumstances of manufacture. Every one knows also that carbonic oxide is a dangerous and poisonous gas, *per se*. These are facts that analyses and physiological research make absolute, and which no one disputes. And every reader of gas history also knows that in the early days of water gas violent opposition to it was made on the ground that because of this larger percentage of carbonic oxide it was unfit to be used. Other arguments failed to stop its growth, and this was one that was much dwelt upon. Finally, under the great pressure brought to bear by the coal gas interests, in one State only (Massachusetts), a law was passed practically prohibiting its manufacture, but later this was modified to allow it in some instances, and still later it was entirely repealed. In another State (Rhode Island) an attempt by opponents of water gas to have such a law enacted was a flat failure, and water gas throughout the Union is to day as free to be made as is coal gas. It is now a matter of fact and statistics that it *is* made in every one of the largest cities, excepting two; that any number of small places use it, either in whole or in part: that altogether about 350 cities and towns actively make it, and that the amount made is probably more than one-half of all the gas made in North America. These are all *facts*, and if they are not a sufficient and practical answer to the question of whether the gas is a fit one to use or not, I do not know what is. To the gas man the additional amount of carbonic oxide rarely makes any difference in actual working. The workmen call it a "stronger" gas, *i. e.*, one that will overpower them more quickly if carelessly inhaled. As a result, in putting in services, etc., they soon learn to be more careful than before in the amount of gas they allow to escape. As far as the public is concerned, all "accidents" are caused either by carelessness, ignorance, or design, and are so much influenced as to their fatality by other factors—of size of room, amount of ventilation, size of burner, etc.,—that in the total number (which is in itself small from one year's end to another) the kind of gas used makes very little difference. But even if, or granting that a slightly increased risk is run in using water gas, the advantages far more than offset it. It is the same with the use of matches, of high speed machinery, of railroads, or innumerable other inventions of man that mark the progress of civilization. In the abstract, or if used ignorantly, all are more or less dangerous than older methods, but when properly used all such things directly tend, not only to the greater comfort, but to the greater safety of mankind. In gas the public wants the highest candle power it can get and the brightest light. Water gas gives it, and no one now objects to it on the score of carbonic oxide excepting "interested" opponents. The use of wood gas directly pertains to this point. This gas frequently contains 40 per cent. of carbonic oxide, and has been in very common use in Germany and in the Southern States. Yet it has never been condemned on account of carbonic oxide, for the simple reason that no one has been "interested" in opposing it.

"*Water gas is harder on meters than coal gas.*"—Summed up, this amounts to: A poorly made water gas is harder on meters; a properly made water gas is not. In the early days much of it, unfortunately, was but little better than a vaporized oil, diluted with a non-luminous water gas. The superheaters used were too small; the oil used was not properly fixed, and the oily vapors carried to the meters undoubtedly had a rapid destructive action upon the diaphragms, causing a high repair account. I am sorry to say, too, that there is still much of this sort of gas made in badly proportioned apparatus. Where the apparatus is so proportioned that the oil vapors are properly fixed the case is very different and no trouble is experienced, and this is the gas, you will bear in mind, that I am considering.

To get the best of expert testimony on this subject I lately wrote to all the meter manufacturers, asking their opinion "as to whether a well made and properly fixed water gas is any more injurious to meters than coal gas." Note the unanimity of opinion in the following abstract of replies:—

"It is our firm belief that if water gas is properly made and perfectly purified it is no more injurious to meters than coal gas.
(Signed) D. McDonald & Co."

"We do not find a well-made and properly purified water gas injurious to meters. (Signed) American Meter Co."

"Of the number we have seen and repaired where water gas is made, we are unable to find any difference.
(Signed) Nathaniel Tufts."

"We consider a well-made and properly purified water gas is no more injurious to meters than coal gas.
(Signed) Harris Bros. & Co."

"We believe that there is no especial difference in the effect on meters of a properly made and well purified water gas as compared with a similar coal gas.
(Signed) The Maryland Meter & M'f'g Co."

"If water gas is made and condensed and purified so that condensation cannot take place in the meters, they will last until they wear out. (Signed) Helme & McIlhenny."

"in our judgment water gas, properly condensed, is no more injurious to meters than coal gas, and the general absence of ammonia and sulphur is in its favor.
(Signed) John J. Griffin & Co."

"Have no hesitation in saying that a well made and properly purified water gas is not injurious to meters, so far as our experience goes. (Signed) Goodwin Gas Stove & Meter Co."

When *all* the meter manufacturers are as unanimous as the above in agreeing on this question, I think we may consider the point settled.

"*Water gas condenses more than coal gas*, hence clogs up burners and fixtures and mains more and makes an excessive amount of drip pumping, etc."—Precisely as before, this claim depends entirely on whether the gas is good or is bad. Water gas that is not properly fixed will condense its oily vapors throughout the city, as is but to be expected, and I might say right here that the secret of making a fully fixed and satisfactory gas is in the superheater. This part of the apparatus must be of sufficient size and rightly handled. In very many plants the superheating capacity is entirely too small and a poorly fixed gas is the result. In later plants that I have in mind the superheating capacity is about four times that of the earlier ones and is found to be sufficient. In his work on "Water Gas in the United States," Mr. A. C. Humphreys (than whom there is no better authority) says, page 16: "So changed are the results in this direction that there is probably no gas better adapted for distribution in extremely cold climates than a water gas made in a modern plant." My own experience has been entirely in this direction. At Lewiston, Me., I had charge of a company for some time. That city is on about the same parallel of latitude as St. Paul, Minneapolis, South Dakota, and Oregon. The winters are long and severe and frost six feet deep is common. We made a straight, good water gas; no excessive amount of condensation was found, and the superintendent of distribution who had been there for years previous, when coal gas was made, stated that he could see no perceptible difference.

Experiments of Dr. Moore upon the comparative loss of candle power by condensation between coal and water gas pertain so directly to the point that I feel warranted in quoting from his report in full. (Moore's Analysis, Report on Granger water gas, New York, 1885, pages 48, 49.)

"Influence of extreme cold on illuminating power.—The capacity for resisting low temperatures is an important requisite for illuminating gas intended for use in this climate. To test the capacity of the Granger water gas in this respect the following experiments were tried:—

"A length of 30 feet of three-eighth-inch lead pipe was bent into two communicating coils about 8 inches in diameter. The coils were placed in separate tubs and one end of the pipe was connected with the service pipe, the other end being attached to the photometer pipe. The tub next to the photometer was filled with water at the temperature of the photometer room and the gas turned on. After the air had been entirely displaced from the pipe and the photometer readings had become constant, the candle power of the gas was carefully determined. The tub adjoining the service pipe was then filled with a mixture of snow, salt, and sal-ammoniac. The gas was allowed to burn at the photometer burner at the rate of about 5 cubic feet per hour until the expiration of 1 hour after the freezing mixture had been applied. The indications of the photometer fell gradually from the time of the application of the freezing mixture, but were in each case stationary for some time previous to the final observations of the candle power. The final readings were taken 1 hour after adding the freezing mixture and the temperature of the coil noted at the same time.

"For comparison a similar experiment was made on the coal gas

at Worcester, Mass. In each case the coils employed were made of new lead pipe purchased for that purpose.

"The results of the foregoing experiments reduced to standard temperatures and pressures, etc., are given in the following table:—

Kind of Gas.	Temperature of Coil.	Candle Power.		Loss in Candles.	Percentage of Loss.
		Before Cooling	After Cooling		
Granger, Worcester . . .	—7.8 F.	22.06	17.36	4.70	21.30
Coal gas, " . . .	—7.6 F.	18.41	11.33	7.08	38.40

"These figures show that the Granger water gas possesses greater power of resistance to the extreme degree of cold employed than coal gas of much lower candle power. That this should be the case will also appear from a comparison of the analyses of the different gases. In the Granger gas the only illuminating ingredient susceptible of condensation by cold is the benzole vapor, and in the Worcester gas this constitutes 11.93 per cent. of the total illuminating hydro-carbons, while in the Heidelberg gas it constitutes 26.13 per cent. The illuminating power of benzole vapor is, however, according to Frankland, when diffused through coal gas previously deprived of its illuminating hydro-carbons by treatment with bromine, nearly six times that of ethylene similarly employed. Simple cold will not, of course, condense all of the benzole vapor from a state of admixture with gaseous substances."

In 1880 Professor Wurtz made similar experiments with similar results.

I think we may safely assume that if water gas is what it should and easily may be, we shall have no more trouble from condensation with it than from coal gas.

"*Water gas is heavier than coal gas*, hence not as much will flow through mains and burners, and one's output will be lessened."—At first glance it seems as though this point might be of considerable importance, but a little investigation will show that in the practical working with the two gases the actual difference is so little, under reasonable operating conditions, that it rarely need be considered.

The rate of flow of gases of different densities, the diameter of pipes required, the pressures, etc., and the formulas for determining questions of this nature are fully given in the standard authority, "Kings Treatise on Coal Gas," Vol. II., page 374, *et seq.*

Let us take the rules we there find and apply them to one or two cases in common practice. Assume a 10 inch main, 4,500 feet long, say from the works to the centre of a town, delivering a sufficient quantity of coal gas of .425 gravity under 2 inches pressure.

How much larger pipe will it take to deliver the same amount of water gas of .625 gravity without any increase of pressure? The formula is:—

$$d = \sqrt[5]{\frac{Q^2 \quad s \quad l}{(1350)^2 \quad h}}$$ in which

d=diameter of pipe in inches.
Q=quantity of gas in cubic feet per hour.
l=length of pipe in yards.
h=pressure in inches of water.
s=specific gravity of gas—air being 1.

Working this out we find that *an increase of but 8 per cent. of the diameter of the pipe* is necessary to allow for the greater gravity of the above water gas. Instead of a 10-inch pipe one would require one 10.80; instead of a 3-inch pipe one would need one 3.24, and so on, for the rule applies to all cases.

In other words, the difference of diameters required for the two gases is so slight, not beginning to equal the next larger regular size main, that if one is working comfortably on coal gas a change can be made to water gas, without any question but that one's mains will do the work all right. That this is so in actual operation is clearly shown by the fact that water gas companies never plan for larger pipes than if they were to make coal gas, and companies that change from coal to water gas continue to use their old mains as before, with no thought of having to enlarge them.

But let us take an extreme case. Assume a company having old and small mains; that all the coal gas is being passed through them that they will carry, and that there is not even the narrow margin indicated above to work upon, in changing from one gas to the other, and that it is desired to make water gas.

The same amount of water gas can be put through as of coal gas before, by simply carrying a higher pressure to offset its greater density. This means that one must balance one's holder or adjust one's governor so as to give enough more street pressure than previously carried to send out the same amount of gas as before.

The formula for determing this is—

$$h = \frac{Q^2 \quad s \quad l}{(1350)^2 \quad d^5}.$$

in which the symbols are the same as in the previous formula. This does not increase the leakage account, as a moment's thought will show, for sending out water gas instead of coal gas, without change of pressure, *decreases* the amount of leakage and readjusting pressure, for the new density simply brings it back to where it was before.

As a matter of fact, however, very few companies allow their mains to become so crowded in working capacity that the pressures carried have to be altered. If such change is needed it is the best of evidence that the mains are already overtaxed beyond the limit for economical coal gas distribution, and that it is high time that they were enlarged, no matter what gas is made. But even in this last case it is not always necessary to increase the pressure carried, for any slight decrease of output resulting from such mains will generally prove but temporary, and for this reason: Our business generally prospers and increases in proportion to the good service given, and if a better light, and a cheaper light (for bettering the candle power is equivalent to lessening the price), and a better service be given by reason of distributing a higher candle power gas, one's business, instead of dropping off, will speedily *react into an increased output*.

I am afraid that in all this I have unduly emphasized the importance of the whole point; very few companies have to bother about the detail of pressure in changing from one gas to another, for, as stated, the increase of business, due to the better candle power, quickly, and more than offsets any temporary shrinkage in output that, through a difference in density, may result from already overtaxed mains.

"*Water gas requires a change of size of, or different burners*, therefore is costly to introduce for whoever pays for them."—This argument is an outcome of the preceding, on the ground that as not as much water gas as coal gas flows through a given sized opening the consumer will not get as much light. If water gas is of no better candle power than coal gas, then the argument is good. But every one knows that water gas can be made of any quality that one pleases; that it is usually several candle power better than coal gas, and that not as much of it is needed to produce the same amount of light. In practice, the increase of candle power about balances the lesser flow. For instance, with five feet of coal gas, giving, say 18 candle power, 1 cubic foot equals 3.6 candle power; with 23 candle power water gas 1 foot equals 4.6 candle power; so that a consumption of 20 per cent. less, or 4 feet, gives as much light as five feet of coal gas of 18 candle power. While if sufficient pressure is carried to maintain the old rate of flow, 5 feet, with water gas, the consumer gets 23 candle power in place of 18, or nearly 28 per cent. more light for the same money.

The claim also used to be made that a different kind of burner was needed for water gas than for coal gas. This may have been true when really a gas more of the nature of an oil gas was burned, but at the present day it is rarely thought of. The burner in universal use is a common bat's wing lava tip, the same as for coal gas, and in size the same also, namely, 3, 4, 5, and 6 feet, according to the consumption or light desired. In regard to this point I am hardly sure whether not having to change burners is entirely a good thing or not. For would not something that would really make a gas company go over, or change all the burners in town, once in so often, be rather beneficial than otherwise?

"*Water gas does not give as much light as coal gas.*"—Cicero says, "*Homines facile credunt quod volunt*," which being interpreted, means, "Men easily believe that which they wish to." When the opponents of water gas made unsatisfactory headway in checking its growth by other arguments, they suddenly evolved this one, viz., water gas is not as good as coal gas; alleging that a white light would not "diffuse" as well as a yellow light; that water gas was locally bright and intense but had not the illuminating qualities of coal gas; that a 20 candle power water gas was really no better than a 16 candle power coal gas, etc. This was in effect claiming that a candle power was not a candle power or that a pound was not a pound, and was gravely attempted without a particle of effort at proof, as far as I know, beyond inviting one to look at a red-hot poker or an electric light as examples of diffusibility and lack of it, and leaving one to figure out where it came in for one's self. This specious claim, being but another form of damning the attorney on the other side when one's case proper is weak, and illustrating the straits to which its backers were driven, has been so hammered in, however, that I have no doubt that there are some gas men who still half-way believe in it, possibly because they want to, but more probably because they do not happen to know positively to the contrary.

I have not the space to here argue out the matter or show the error in it, but I would refer all who are still in doubt to a careful reading of a paper by Alexander C. Humphreys, read in New York, in October, 1887, before the American Gas Light Association, entitled "Illumination *versus* Candle Power," where the question is treated at length. Both theory and practice are taken up and a long series of experiments described that were made with 16 candle power coal gas, 23 candle power water gas and with the Welsbach light, which latter was as much whiter than the water gas as the water gas was compared with the coal gas, thus making the test particularly severe. I quote from the summary of results as follows: "These experiments conclusively proved that the white light is diffused exactly as well as the yellow, there not being a particle of difference in favor of either. These are facts beyond which we cannot go."

"*Water gas is dependent upon oil;* this may increase in price to a point prohibiting its use."—Of course, no man can say what will or will not happen in the future. I am entirely sincere in the opinion, however, that no great trouble need be apprehended on this score for a long time to come, and for this reason, namely: it is to the interest of the oil people to keep the price at such a figure that water gas will compete in cost with coal gas; otherwise they would

lose one of their largest customers, and we in the gas business know what that means. Since self interest lies that way, we may expect a continuance of low-priced oils. If all oils were done away with, gas coals then having a monopoly would go bounding up in price and, *per contra*, so would oils if the supply of gas coal should cease. In other words, each acts as a check on the other to keep it at reasonable rates. To my mind, both materials will always be used as far as this generation is concerned, and neither can afford to let the other materially underbid it, without for its own protection, following it in price. As to the giving out of actual supply, I do not fear that as yet. Do you imagine that such a corporation as the Standard Oil Company expects to go out of business in any near future, or that the oil industry will cease? New fields are constantly discovered and much work remains to be done. The "Southwestern" territory has been lately opened in Pennsylvania and the refining of crude Lima oil has as yet hardly commenced. In the neighborhood of Toronto a local Canadian oil is used for water gas plants. In Southern California there are fields to supply that territory. Wyoming promises to be a large field. In Colorado oil of excellent grade has lately been found; and in Indiana the Terre Haute Gas Company, in drilling for natural gas, struck a good oil field on their own lot, and, I imagine, get it at pretty nearly cost. There are numerous other States also where oil has been found in moderate quantities, and I have no doubt whatever but as old fields fall off in production, such places will be developed and oil will be found in quantities and in territory that we now have no idea of. I have also been informed (whether correctly or not, I cannot say) that Russian oil can be laid down in New York harbor by tank steamers to compete with native oils when necessary. So far there is, of course, no money in it, as Lima oil is so cheap. Russian oil fields are immensely larger than ours, and its product has already, I am told, cut into the Standard trade in England. This oil has already been used in water gas manufacturing with very satisfactory results. So, taking it all in all, the great number of places the oil is found, giving us good assurance of its continuance, and the object that it is to the oil people to maintain prices that will compete with coal gas, I think it is borrowing trouble to worry as yet over the oil supply.

"*Water gas apparatus necessitates the use of anthracite*, hence is not adapted to all parts of the country."—The idea was, I presume, that only near the hard coal fields could it be profitably made. The fact that it is made and has been made for years in Maine, Manitoba, California, Louisiana and Florida, and all sections in between, is a sufficient refutation of this claim.

Anthracite coal evidently then is hauled and laid down cheaply enough for its economical use in localities far distant from the mines. The main present source of supply in Pennsylvania is, as far as we are concerned, inexhaustible; in addition it is brought as ballast from abroad to the Pacific slope, and in Colorado are active working mines, needing but better railroad facilities to enlarge their market.

All this, moreover, is taking no account of coke, which is now not only used but equally as well used, in generators of modern design, as anthracite. By coke I mean both "gas-house" or retort, and oven coke. Every gas works large enough to make both coal and water gas has its source of generator fuel supply in its own yard. In addition oven coke is made in many States from local coals. The Connellsville coke of Western Pennsylvania is famous, and no better fuel do I know of for generator purposes. Oven cokes vary greatly in quality, like soft coals, but in efficiency a good coke, such as Connellsville, or a good gas house coke, will make as much water gas per pound as does anthracite. Some water gas men prefer one, some the other.

"*Water gas means high pressure and 'blowing' at the works.*"—The idea prevails to some extent that it is necessary to have deeper seals and larger pipes, etc., for water gas than for coal gas, to prevent trouble of the above nature at the works. That depends entirely upon how the works and water gas apparatus are connected up. The old way was to connect right on to the existing coal gas works. Of course water gas, being made at times very rapidly, created high pressures, and ordinary shallow seals, designed for coal gas pressures, would "blow." This trouble is entirely overcome by the present practice of putting the water gas as made directly into a small holder, and from there drawing it by exhauster and passing it through the works at no higher pressure than, and precisely as though it were, coal gas. In this way even a *more* uniform flow of gas is had than in coal gas practice, for the supply and pressure from the small holder is constant, which is not so from benches, as the necessity for a governor on the exhauster shows us. This use of a small holder does not decrease the storage capacity, for should the production cease for any reason, the gas in the relief holder, as it is called, is *made* and needs but to be passed through the works to be used. In small companies having only one holder, and hence unable to work on the above system, the practice in adopting water gas is to deepen the seals, to provide for the higher pressures, or, if this is impracticable, paraffine or some other substance is used instead of water in the seals. When cold, paraffine is hard and will not blow, but when warmed it liquefies and permits the purifying covers to be readily raised. While many small companies make water gas as above, *i. e.*, without a relief holder and with good satisfaction, yet I think it is generally conceded that the better plan is to use such a holder.

"*Water gas makes no commercial residuals*, hence coal gas must be cheaper, having coke and tar, etc., to sell. This is one of the weakest of arguments, for in any comparison of costs it must be net cost against net cost in each case. And will any one seriously tell me that he would rather have residuals to dispose of than not? I am well aware that an enormous business has been worked up in tar, ammonia, and coke, but is it not the outgrowth of sheer necessity, of disposing of and of getting some return from the by-products of coal gas, rather than from choice? If coal gas men could be relieved of the necessity of keeping a large outfit for disposing of coke; of collecting and selling tar; of saving and hunting a market for ammonia, and yet make gas as cheaply as with these items as now credited, would they not gladly relinquish all this work now necessary? It may be laid down as an axiom that other things being equal, any manufacturer, no matter what his business, will prefer that system of manufacturing in which all his raw material is converted into finished product, and no residuum remains to be disposed of.

"*Water gas tar is worthless and troublesome to get rid of.*"—There is one residual, however, in making water gas, and that is tar. Until lately it was considered worthless, and so little of it is made that in very many and in small works, unless one has no drainage it hardly pays to catch and save it. With naphtha and good apparatus almost none of it will be made. With crude Lima oil, I believe that there will always be more or less of it. The actual amount and its quality is an excellent index of the efficiency of the apparatus for handling Lima or other heavy oil.

In the best forms that I know of, where a careful record is kept, the minimum of tar made averages about one third of a gallon to each 1000 feet of gas; older forms and less efficient apparatus frequently make three times as much, of course at the expense of an additional amount of oil. The water gas tar, as first made, contains much water, and to be used must be separated in some sort of settling tank, with siphon draw-off pipes, etc. It may then be sold for numerous tar purposes, or may be burned to advantage under one's boilers. In one good-sized water gas works that I know of, where this latter is done, the coal used under boilers is reduced to but 3 pounds per 1000. At another works where on an old apparatus an unusual amount of tar was made, it was subjected to a concentrating treatment and worked up into a fine pitch for street paving, coming into successful competition with Trinidad asphaltum for this purpose. Some of it also was worked up by simple treatment into an excellent varnish for painting and preserving, etc., selling for $10 a barrel. In several places that I know of 6 to 9 cents a gallon is a current price paid for water gas tar with the water eliminated.

All of which shows that if one has no means of getting rid of it, it can be readily saved and disposed of, and at a profit; hence is no longer a nuisance.

"*Water gas costs more to purify than coal gas.*"—Whether this is so or not depends entirely on local circumstances. With water gas made from naphtha the cost of purification is no more, and is sometimes less than coal gas; even when made from crude oil it is but little greater than from naphtha or in coal gas, even with the additional amount of sulphur in this oil. The amount purified per bushel varies so much in different places, owing to the different conditions of size of boxes, material used, rate of flow, oil used, coal used, and efficiency of scrubbers and condensers, that no fixed amount can be laid down as a standard of what should be done, and those of you who have tried to compare figures know that this applies equally well to coal gas purification. I believe, however, that using straight lime and Lima oil, 12,000 to 15,000 feet should be purified to the unslacked bushel; using oxide, the amount should be considerably higher—say from 15,000 to 25,000 feet per bushel. One fair works that I know of, making in November 5,000,000 feet, using one-fifth lime and four-fifths oxide, averaged 19,200 per bushel of the mixture. This figures out to but a fraction of a cent per 1000 for cost of purification. I think it may be accepted as a fact, that there is no wide difference in the cost of the purification of the two gases, and whatever difference there is, either in one direction or the other, is so slight that it is very rarely considered of any moment, as affecting the question of whether to make water gas or not.

"*Water gas requires more skilled labor for gas makers.*"—The usual custom in changing from coal to water gas manufacture is to pick out two or three of the best stokers to run the water gas apparatus and to let the others go. It is but natural, and beyond that no selection of men or better grade of men is necessary. I find that throughout the run of water gas works the average gas makers run about the same grade as good stokers and get about the same pay, varying in different localities from $1.50 to $2.50 per day; $1.75 to $2.00 is a common rate in the majority of places. In the South colored gas makers are not infrequent. Although more constant attention is required in running water gas apparatus than coal gas benches, yet the actual hard work is so much less severe that the great majority of gas makers whom I have asked and have made both gases state that they prefer "the new way of making gas."

"*Water gas involves danger from the necessary storage of oil.*"—When other arguments begin to lag this question is generally brought up. There is no question that oil in large quantities is dangerous if carelessly stored, but the real question is, is it dangerous if reasonable care be taken? Perhaps the best answer to this is that of the insurance companies. Crude Lima oil has appeared on the market in such large quantities that to dispose of it large amounts are used as fuel under boilers in manufacturing establishments of all sorts. The question of safety early arose.

After carefully looking into it the insurance companies (than whom there is no better barometer of a danger risk) ruled in effect that if oil was so stored that it could not flow by gravity towards buildings no general additional insurance rate would be made. With this one point complied with, no additional danger is incurred. It means that the storage tanks must be located at the lowest point of the gas works yard, or in a pit, so that in case of accident, if a leak should start, the oil will remain there and cannot flow towards buildings. A pump, of course, then becomes necessary to draw it up in small quantities, as needed, for daily use in the generating room. This is the right way to equip, and if followed out no more danger need be apprehended than in the purifying house.

At the same time I do not wish to underrate the danger if foolhardy risks are taken. Oil vapors are inflammable, and the man that didn't know it was loaded that hunts-for-leaks-with-a-light generally pays the penalty. The moral is that the oil house should be kept padlocked, and only responsible men attend to it. One of the great points that the general use of Lima oil has attained is the reducing of danger from handling oil in bulk to almost nothing as compared with naphtha. This latter, as you all know, is extremely volatile, while the former gives off but little vapor. I have dropped a lighted match into a saucer of crude Lima oil without igniting it, which, of course, is impossible with naphtha. It well illustrates the difference between the two, and shows how much danger has been eliminated by the substitution of heavy crude oil for the volatile naphtha.

"*Water gas uses more water than coal gas.*"—I have heard the above conclusion sometimes jumped at for the reason, I imagine, that in making gas from water the first impression may be that enormous quantities of it are required. This is entirely erroneous. The great bulk of water used around gas works is for quenching coke, for use in scrubbers and condensers, in holding tanks and steam boilers, and for washing and minor purposes. In water gas an increased amount is used for steam making purposes, but this is offset by the fact that no coke is made and no water is necessary to quench it, and the net result is that there is no great difference in the total amount used between a coal and water gas works, and the item is so slight, being usually but a small fraction of a cent a thousand in either case, that practically it rarely is considered in the question of which gas shall be made.

So much for the old arguments against water gas. I can think of no more than I have given above. I think you will agree with me that some of them have no foundation whatever; that most of them no longer hold good; that what few have any foundation in fact amount to but very little in practical working, and that their sum total at the present day carries but little weight. I will summarize them further on.

Let us now consider the points that the general experience of the past ten years has shown are arguments in favor of making water gas.

ARGUMENTS IN FAVOR OF WATER GAS.

Water gas can be made of higher candle power than coal gas.—This fact is no longer questioned. When such a man as A. B. Slater, ex-President of the American Gas Light Association, voluntarily writes, "The question of quantity and quality of light given water gas is no longer a mooted one." ("Why I shall make water gas." New England Association, 1890.) And again, "A higher illuminating power can be furnished with less liability to smoke." ("The value of a Water Gas Plant as auxiliary to the Coal Gas Plant." Society of Gas Lighting, 1890.) And when it is common knowledge that water gas of 25 to 30 candle power is daily made in numerous cities and towns throughout the country, the fact is evident.

The logic of it is very clear. Water gas is simply making by composition the same gas in the main (carbureted hydrogen) that is gotten by extraction in carbonizing coal in coal gas, the chief difference being in a varying of the percentages of the constituent gases, and the substitution, as a diluent, of carbonic oxide in the former in place of the marsh gas in the latter. The hydrogen is obtained from water, and liquid hydro-carbons or oils are used to carburet it, and it is evident that more or less hydro-carbons can be added at pleasure to make the illuminating value desired. The only point to be observed is that sufficient provision must be made for "fixing" or making permanent the extra hydro-carbons added. In coal gas it is impracticable to enrich in ordinary benches to over 20 candle power by either cannel or oil without too great a tendency to smoke, for two chief reasons: First, its composition. Marsh gas forms a large percentage of the diluent gases. This gas burns with a weak or "flabby" flame, comparatively speaking, and with a strong tendency to smoke. A good instance is seen of it in natural gas, which is chiefly marsh gas, and has but little illuminating power. Its weak flame is well known, and also the large deposits of carbon that will collect from its "smoke" where such is permitted. In water gas the large percentage of marsh gas is replaced by carbonic oxide, which gas burns with a much firmer flame, giving better combustion and flame definition and a corresponding reduction and a tendency to smoke. Second, the gases quickly leave the retorts and do not have sufficient contact with the hot fixing surface for making permanent any great amount of illuminants. In water gas, on the contrary, there is an enormous amount of hot fire-brick ("checker work") through which all the gas must pass, by reason of which (with the thorough baffling and contact that it gets and the great amount of fixing surface) a much greater amount of hydro-carbons can be cared for. For these same reasons, for given candle powers, say 20 candle power water gas against 20 candle power coal gas, the former will be less liable to smoke. Old apparatus, having comparatively small superheaters, in attempting to make a high candle power gas, frequently failed, or rather, the gas, while of high candle power, was not properly fixed, and hence had a strong tendency to smoke and condense. This, doubtless, is largly responsible for the early impression that it was not possible to make a *good* high candle power water gas. But those who may now question it are similar to those who, familiar with but 40 or 60 pounds steam pressure, do not believe that higher is elsewhere carried. Their lack of knowledge (or unbelief) does not alter the fact that locomotives daily carry 150 pounds or more, and that even 225 is carried in one boiler of stationary type that I know of. Likewise a good high candle power water gas *is* now daily made by both superheater and retort systems, by evidence that is indisputable. The policy of it is a question of local determination. High candle powers, however, are the order of the day, and to make such of satisfactory quality above 20 candle power, some good system of water gas must be employed.

Water gas is the best gas to compete with electricity.—As a direct result of the high candle powers possible. We all know that among the greater number of light consumers (excepting hotels, theaters, and a certain class of business, where electricity has peculiar advantages) the economic question comes down to the most light for the least money. It is shown by the history of electric companies competing with the local gas companies. After the first *furore* is over consumers drop back again to the gas company, because from gas they get more light for less money than they can from electricity. In other words, incandescent lighting generally costs more than gas, candle power for candle power; and we are most of us familiar with the elastic system of rates charged in the desperate effort to gain a foothold or to hold a business, even though at such rates the electric people are rarely enabled to earn a dividend. Now if the gas company will perceptibly raise the quality of its gas and will put out a thoroughly good candle power, the difference between the two services will be all the more plainly marked, and lost consumers will return to the fold with proportionate rapidity. I do not mean coal gas, enriched but a candle or so more. That may be a good coal gas, but it is not sufficient. I mean not less than 24 or 25 candle power water gas; not nominally so, but actually so. A gas standing up with a good, clear, well-defined white flame, one that, as we say, "shows up in great shape." With such competition I can assure you that the electric opposition will have a hard row to hoe. I have been "through the mill" myself and have talked with others who have, and it is my firm belief that the best weapon, by odds, to forge ahead against incandescent opposition is a high candle power gas, well maintained and backed up by a good service generally. It is but reasonable and logical, and so thoroughly advantageous is it found that it is a chief reason for the Company with which I am connected maintaining at its various works not less than 22 and, in several stations, 25 and 30 candle power.

Water gas is the best enricher for coal gas.—It is generally accepted that with cannel or oil, as already stated, coal gas cannot be enriched beyond 20 candle power without excessive liability to smoke. But with water gas, that can be made of 30 candle power or over, and so well fixed that there is no undue liability of trouble from this cause, coal gas can be enriched to as high a degree as reasonably desired. Using water gas in this way also gets rid of cannel coke, which I understand is practically worthless, and, in addition, gives one at hand, even if put in solely for this purpose, all the other advantages of a water gas annex. The nicety of adjustment possible of the mixture of the two gases to any candle power desired is not to be forgotten.

Water gas is made more quickly than coal gas.—This point is fully accepted, and I need not dwell upon the fact itself, but I wish for a moment to show how much that means in convenience, safety, and economy of working.

Quick production is self-evidently a most desirable attribute. If one has a mill town, or is liable from any cause to have a sudden heavy demand for gas, what is there better than a plant that can, according to size, in from three to five hours after starting up, be making gas at full speed of from 5,000 to 75,000 feet per hour, or, if that be not sufficient and a still greater capacity be called for, one that can be speeded up temporarily to make 30 to 50 per cent. more then its normal running capacity? And all this without detriment to the apparatus—a thing that is impossible with benches. Note for a moment how well such a plant works in, as auxiliary to a coal gas works, to take care of the fluctuation of output when ordinarily benches have to be kept idle but under fire, for that purpose. Mr. Light well puts it, as follows: "A gas coal plant can be run more satisfactorily, and the gas made at considerable less expense, where a water gas plant is being run in connection with it. No idle benches on Sunday or Monday; no extra benches under slow fire, ready for sudden increase of consumption. The variation in the output is supplied and controlled by the water gas plant."

Water gas requires less holder room.—This is a direct sequence of the preceding point. Most works have ample holder capacity for nine months in the year. It is only during the dark days of November, December, and January, when the output is oft-times greater than the make, that they are apt to be crowded. At such times the custom is to have large enough holders to have a reserve stock of gas on hand. In coal gas this is necessary, or else an excessive number of retorts must be kept under fire, ready to

charge when needed. In water gas, on the contrary, from the ability to "speed up" or to increase the make; or to start up a second set in a few hours; or to simply run more hours than usual per day, as much holder room is not needed for equal safety. Several companies that I know of have installed water gas plants for the express reason of deferring the erection of a new and large holder, costing probably twice as much as the water gas plant.

Water gas apparatus costs less than coal gas for equal capacities in the larger class of works.—In many works of medium size, the cost will, I think, be found to be about the same as for bench work of corresponding capacity, although figures, of course, will vary greatly in extreme cases. There are numerous patents on regenerative and recuperative benches, and on many forms of water gas plants. Royalties and licenses vary greatly, and no fixed figure can be laid down as to what costs will be. But again, in many medium-sized works and upwards, owing to the larger generating machines possible to be built for water gas, this system can usually be put in for given capacities for considerably less money than is necessary for a stack of benches. And in extremely small works it will nowadays usually be found, all things considsidered, the cheaper plant to install. Good apparatus is now sold at reasonable rates, and even though a couple of benches of threes may perhaps be put in for less money, yet coal gas on such a small output costs so to make, and water gas is so well adapted for small works, that it will usually be found cheaper in the long run and most satisfactory to make the larger investment, and to put in one of the small sized water gas machines.

Water gas requires less floor space than coal gas.—I have taken some 15 typical, modern plants of the form occupying the most floor space and the inside size of buildings in which they are located, and have figured out the average amount of floor space required per 1000 feet daily capacity. I find that—

Water Gas Plants of capacity in 24 hours of	Require an area of floor space for each 1000 feet of about
100,000 cubic feet.	4. square feet.
200,000 cubic feet.	3.50 square feet.
400,000 cubic feet.	2.75 square feet.
600,000 cubic feet.	2. -2.50 square feet.
7,000,000 to 10,000,000 cubic feet.	1.25-1.50 square feet.

These figures do not include engine and boiler rooms, but do include scrubbing and condensing plants, which are never located in the retort room, so that one about balances the other. In a few forms of water gas plants even less space is required than here given, though usually at the expense of higher buildings. Some few forms also require more room than the above, but I believe the figures given to be reasonable for the great majority of plants.

Comparing with coal gas, I will assume a stack of 16 benches of 9s, back to back, regenerative settings, turning out 10,000 to the mouthpiece, which is, I think, as efficient a plant as we can now build. Such benches will run from 11 to 12 feet centres and the stack will take a building not less than 60 x 120 feet. Taking the total capacity at 1,500,000 for 24 hours gives 4 8-10 square feet as the area floor space requisite per 1000. It should be remembered, however, that the great bulk of coal gas work is done on benches of 6s, about 9 to 10 feet centre to centre. Assuming a small works of 6 such benches, in a room 30 x 60 feet, each bench averaging 50,000, or a total of 300,000 per day, gives us 6 square feet per 1000 as the more usual amount of space occupied. By comparison with water gas figures it will be seen that depending upon the size plant in question, water gas requires for floor space for the same capacity of plant but from two-thirds to one-fourth the floor space requisite for coal gas.

Water gas requires less yard room than coal gas.—This is evident from the fact that no coke is made, and hence no sheds nor space for coke pile or yard room for handling it is necessary. In old works, hemmed in by a growing city, this is frequently a point of considerable importance where additional generating capacity is required. It should be borne in mind also that the accompaniment of crushers, bins, cokemen, weighers, horses, carts, and stable room for coke service are all done away with.

Water gas requires less storage room for materials.—Figures show this conclusively. A ton of bituminous coal requires 43 cubic feet storage room, and will yield, at 5 feet to the pound, 10,000 cubic feet of gas. A ton (2,000 pounds) anthracite requires from 33½ to 37 cubic feet storage room, and will yield, at 50 pounds to the 1000, 40,000 cubic feet of gas. A ton of coke requires 80 cubic feet and will make the same amount of gas. To this should be added the necessary room for oil storage, which amounts to two-thirds of a cubic foot for 5 gallons per 1000, or about 27 cubic feet for 40,000 feet of gas.

Taking these figures I find that we need for cubic feet storage room for materials for 40,000 feet of gas:—

172, or 1 cubic foot for every 232 feet of gas made, in coal gas.
107, " 1 " " 373 " " " water gas from coke.
62, or 1 cubic foot for every 645 feet of gas made, in water gas from anthracite,

or a difference of from about 1 2-3 to 2 3-4 times in favor of water gas. I give here a table of the storage room required for the chief gas-making materials:

Table of Cubic Capacities.

Anthracite Coal (Egg and Broken).	Cubic Feet required for 2000 Pounds	Weight in Pounds per Gallon.	Cubic Inches required per Gallon.	Cubic Feet required for 5 Gallons.	Weight per Bushel.
Lehigh and other hard coals	33.30-33.80				
Wilkesbarre district	34.35-35.				
Lackawanna district	36.65-37.10				
Bituminous Coals.					
Youghiogheny	42-44				
English rule is	43				
American cannel	41 50				
English cannel	42.30				
Cokes.					
Average gas house	80				40
Connellsville oven	80				40
Oils.					
Crude Petroleum		7.30	231	9/5	
Naphtha		7.07	231	9/5	

Water gas in a combined works maintains the coke market.—Wherever it be found wise to make both coal and water gas, the former becomes a direct means of maintaining the value of the coke made in the benches, for the reason that, if there is a poor market locally it can be used in place of anthracite in the generator as fuel and to quite as good advantage. Many works use it altogether and prefer it. Some claim that in its use the amount of gas made per set per day is 10 to 20 per cent. less. Probably with shallow generators and old plants this is so; but in modern settings it yet remains to be demonstrated how much there is, if any, in falling off of make. In efficiency it gives pound for pound, as high a yield as hard coal, 1 to 1½ bushels being the common amount per 1,000. Owing to its friable nature and the intense local heat of combustion it is better in using it to shorten runs somewhat, and slightly readjust heats. The ready use of coke in this way in combined works renders them entirely independent of anthracite, and in places where natural gas or other causes have induced low prices for coke this use of it becomes a most important factor in economical working.

Water gas causes less trouble from naphthaline.—I will say frankly that until reading the discussion following Mr. Light's paper I had never heard the claim made that water gas caused more trouble than coal gas, but had always believed and considered it as practically admitted that distinctly *less* trouble is experienced from naphthaline in its manufacture. And after carefully analyzing the discussion referred to, and the causes for the naphthaline trouble there recounted (which trouble seemed to be unwarrantably laid at the door of water gas) I see no reason for changing my belief.

For instance, Mr. Clark, of Elyria, had great trouble—"plugged up everything and was going to quit the business." *A change of gas makers* made it all right. His troubles ceased, and now "he really begins to like the gas business." His trouble was manifestly from poor handling of his apparatus, and not because it was water gas that he was making. Mr. Faux, of South Side, Pittsburg, "was troubled with naphthaline, one day in one part of the town, one day in another." A mixed coal and water gas was what he was making, but since the introduction of *a new scrubber* and a *new oil feeding device*, he has had no trouble. Surely it is not fair to blame water gas for troubles that so evidently came from the handling of the gas in his works, and that were so readily cured. Again, Mr. Light describes how in a pipe running under a "hydraulic" (which I take it is a canal?) continual stoppages occurred, which were cured *by running the pipe over a bridge*. He also states that naphthaline bothered the works one year, and then shifted its base (of) operations, so to speak, to the streets the next; that they had it before they put in water gas, and, in short, could not control it at all. Then, on the other hand, Mr. Faben, of Toledo (whom it is to be noted was operating a much more modern apparatus than the others), reported that he had had no trouble whatever. Will any one fail to herein recognize the vagaries of the beautiful crystalline deposit, that comes and goes whither it listeth, some time or another, at nearly all gas works, irrespective of what kind of gas is being made? In short, how much do we positively know concerning the causes and formation of naphthaline in either coal or water gas? Unfortunately, far less than we should like to. One works has it, and another apparently under the same conditions never has it. A slight change of conditions makes it appear or disappear, and why we can but surmise. I say, then, that we have no right to charge unusual trouble from naphthaline to water gas when the great mass of evidence throughout the country at large is in a directly opposite direction, namely, that *less* trouble is had.

To satisfy myself on this question I lately inquired of about one hundred gas men (writing to some and in conversation with others) their views on the subject. I selected them haphazard from a gas light directory and as I met them, covering all parts of the country, and took care that the very great majority of them were either making both gases or had had experience in both; they were representative gas men, of both high and low degree, and

nearly all processes were represented. Most of them did me the favor of a reply. I asked which, in their opinion, is the least apt to cause trouble from naphthaline, coal or water gas; in what proportion would they express it; their ideas as to the causes of its formation, and, if troubled with it, how they would aim to correct it? I was struck by the unanimity of the replies. With but very few exceptions they agreed that with reasonable care and modern apparatus in each case water gas was much less apt to give trouble from naphthaline than coal gas. Most expressed it as "less than half the trouble." Many "but a third the trouble;" and one of the most prominent gas engineers in the country expressed it as "one-fifth." They were also practically unanimous in the opinion that naphthaline in water gas manufacture came from too high heats and from sudden "shocking," from condensing the gas too rapidly, or from both, and the general suggestion as to remedy was to moderate and watch heats more closely and to avoid a too sudden chilling of the gas, by running condensers and scrubbers a little warmer. Many had had little or no trouble in water gas making from naphthaline, and hence could say but little on the subject. I have sent out many circulars, but have never had as unanimously concurring replies. In view of the above, I think we can say that distinctly *less* trouble is experienced from naphthaline in water gas manufacture than in coal gas. The letters are on file in my office for any of you who are curious as to further details.

Water gas requires less labor per 1,000 for manufacturing.—This is a point generally well accepted; the comparison, however, is of interest. The usual mount of gas made per man, and its cost per 1,000 feet in coal gas manufacture for retort-house labor only, is of course familiar to you. I believe it runs from 8 to 15 cents per 1,000, 11 or 12 being, perhaps, for well-managed, good-sized works the most common figure. In medium-sized water gas works the generating labor account will average from 4½ to 7 cents per 1,000 (two men to a shift to do all the work). In larger works and upwards such labor is very much reduced. In the very small works of either gas it is hard to make an exact comparison, as the man "has to be paid so much a month, any way." I can only say that in such a case (where one man does everything), in making water gas he will have even more time for other work than actual gas making, and hence the company that employs him can run a considerably longer time before having to add a second man regularly to its payroll than in making coal gas.

Water gas is the best system for the prevention of strikes.—There is perhaps no matter of more growing importance confronting the gas manager than the question of labor and control of the men, especially in large companies. The agitation for eight hours and the stokers' strikes at home and abroad, together with the growing tendency of labor in general to dictate terms to the management, make it self-evident that the system employing the least labor to operate it is bound to have the preference. As just shown, less labor is required for a given make of water gas than for coal gas. This, then, is a potent reason for its adoption in the larger cities, where coal gas stokers are numbered by the scores of hundreds and where a strike in the gas works is a matter of the gravest consequences. Even where it is intended to make the bulk of the gas from coal, the wholesome influence upon the men of a water gas annex is sufficient reason for its installation. It holds equally good also in a moderate-sized works, making, say, 20,000,000 a year or less, for in such a case if a strike, or sickness, or disaffection of the gas makers from any cause occurs, the superintendent can take an office boy or common laborer and make all the gas himself, and meanwhile be instructing a new gas maker who can learn in a few days' time. The introduction of water gas into England is primarily due to this question of labor troubles. Touching strikes, I might add that it is not alone strikes in a gas house that arise to trouble the gas men. The late lockout and labor troubles in the largest and most prominent gas coal mines are doubtless well known to you, and to many probably to your sorrow. Good coal supplies were cut off and gas managers had to use anything they could get, and some that I know of are devoutly thankful that they had installed water gas plants which largely assisted, and in certain cases were the only means that enabled them to pull through. It well illustrates one of the arguments for combined works, namely, in case of high price for or failure of supply of materials for one method of manufacture, the other can be utilized.

Water gas houses are much cleaner than retort houses.—The use of hard coal or coke, giving comparatively little dust or smoke, and the confinement of the oil used for enriching in pipes, enables the generator house to be kept far cleaner than a retort house. There are no clouds of smoke rolling up to the roof and no grimy or dirty walls. The building may be kept clean by whitewash and paint with ease, and the gas maker himself be much more clean and comfortable than a gas house stoker. And I hold that the indirect effect upon the men of having a high standard of order and cleanliness has a direct financial value to the gas company. Mr. F. H. Parker, of Burlington, Vermont, at the 1890 New England Gas Meeting, in a paper entitled, "A Few of the Advantages of Water Gas over Coal Gas for Small Works," has even put on record the fact of having made water gas in a dress suit, although I do not find that he advocates that garb for daily use?

Water gas repairs are less than coal gas.—The repair account in either system is mostly confined to the renewal of fire-brick. I have written to a number of the leading fire-brick manufacturers for data concerning benchwork renewals. They practically agree in the opinion that an average retort will yield during its lifetime from 4,000,000 to 5,000,000 cubic feet of gas, and that the cost of renewal and setting of same in a bench of 6s is about $60 per retort. This shows that the average fire-brick repairs and renewals in coal gas amount to at least 1 1-5 to 1½ cents per 1000, even in the very largest works, and that they are frequently over these figures is well known. I am aware that in some instances the life and yield of retorts is considerably more than the above, but I think the figures given will be found to be very close to a fair average. In water gas manufacture the regular renewals consist of replacing fire-brick around the coal bed and some of the superheating filling or "checker-brick," that may have become excessively carbonized or saturated with oil. The average cost for this work in works of various sizes, the figures of which I have access to, is in the very largest works but a small fraction, such as one-tenth or one-eighth of a cent per 1000. In the great run of middle-sized works one-fourth to one-half of a cent will cover it, and only in the very smallest of plants does this item reach one cent.

The main linings of generators and superheaters, like arches in coal gas benches, last for years and years. The reseating of fire and furnace doors, and changes in small piping, etc., cut hardly any figure, and amount to no more than the same in a retort house.

Water gas dispenses with Sunday labor or night work, if desired.—I will not here argue the point of Sunday labor; that is a question of moral belief, of policy, or of necessity that each man must settle for himself. I simply wish to call attention to the fact that with sufficient holder capacity to carry over Sunday, and the ability to bank fires without injury to the apparatus, it is possible in water gas making to do away with Sunday labor, if desired, and it is practically impossible to do so in coal gas making, owing to the necessity of maintaining heat on benches. The same applies to night work. In very many of the smaller size water gas works no Sunday or night work is done whatever.

Water gas is the best system of manufacture for defense against competing companies.—When opposition companies endeavor to get franchises, the argument nine times out of ten is made to the public and to the committees before whom they are heard, that they propose by the use of modern apparatus to give the city a cheaper and a better gas than the old company is furnishing. If the old company, however, is making water gas, either in whole or in part on any modern lines, they are in a position to destroy such an argument (which is apt to be a chief one) completely, by showing absolutely that they, the old company, are equipped with water gas apparatus; that they can make as high a candle power gas as is called for, and, in short, can give the best that is known in gas manufacture or to gas engineers, and *that the new people cannot do any better.* This is a point that I quite grant is not of daily occurrence, but the argument when it is needed is—like a revolver—apt to be needed very badly.

Water gas diminishes the care and worries of the superintendent.—A gas man has hard enough work and care in reducing expenditures and in increasing sales at best. If this can be lessened by the use of a system in which there is the least liability of getting caught in dark weather, or from accident to the holder, or of trouble from naphthaline, or from strikes, etc., such a system is self-evidently the best. I do not claim that water gas cures all these troubles (would that it did), but it does much to lessen the liability of getting caught, or the seriousness of the case when one is caught; and I claim that in the race for supremacy and competition of today that that system is superior which in any wise relieves the strain on the management or lessens the dangers that to a greater or less degree are concomitant with all gas manufacturing.

So much for the points in favor of water gas. You will note that I have not as yet on either side touched upon the

COST OF MANUFACTURING WATER GAS.

This, of course, is a crucial point. I am not one of those who sweepingly claim that water gas is always cheaper to make than coal gas. It depends entirely upon local circumstances and the particular works in question. I have come in contact with an unusually large number of both coal and water gas works and with their operating figures, and the following expresses my opinion upon this point and covers the facts, I think, correctly at this date.

First.—I believe that in the majority of cases throughout the country, and excepting those places that are right in the soft-coal fields, that water gas can be made the cheaper, although in works of the largest size the costs of the two gases frequently will be very near together. If gas coals are cheap, high prices received for coke, steam stokers and regenerative benches employed, and residuals carefully worked up and disposed of at good prices, coal gas can certainly be made at a very low figure; but also water gas, under similar conditions, employing but a few men to handle machines that can turn 1,000,000 feet a day each with cheap, crude oils and cheap coke can also be made at extremely low figures. It is perfectly obvious that in each case the conditions have to be carefully worked out, and until that is done no arbitrary statement can be laid down as to which gas will prove the cheaper. It should be borne in mind in this connection that it is almost entirely due to the great production of water gas that coal gas can be made even as cheaply as it is. The curtailment of tar production has advanced the price of what tar is made, etc., to a point for which the coal gas men can but thank the water gas men. This leads to—

Second.—In many large works, and in works of medium size, a mixed coal and water gas can sometimes be made more cheaply than either gas alone; for it will be seen that the water gas end can best take care of the fluctuations of output, and can use for its fuel

coke from the coal gas benches (thus getting a double yield, so to speak), while a high price may be had for the other residuals, and the benches proper may be run with absolute uniformity and highest economy to the end of getting a high yield per pound regardless of candle power, which can be later raised to any desired point by the admixture of the water gas. Numerous other economies come in in the operation of a combined works, and I find it a rapidly and steadily strengthening opinion among gas men that where it is possible a combined plant is the best and the nearest to an ideal gas works.

Third.—In works of moderate and small size, in the great majority of cases, I believe that water gas is the cheapest system to operate. In such size works, making coal gas, it is not generally possible to work up residuals to their fullest value. Double shifts are invariably necessary, and the inability to make a high power candle gas is usually taken full advantage of by the incandescent electric companies, which cut into the gas companies much more than in big cities. In making water gas in medium-size works double shifts are frequently dispensed with. Owing to the flexibility of the apparatus, moreover, the labor that is employed can be used to much better advantage, and much more time be had by men at the works for other things besides actual gas making. In very small works, in fact, one man can make gas half a day and "do work up town" the other half, instead of always being tied down to a retort room.

It is obviously impossible for me, having no knowledge of the local conditions, to cover this part of the subject as completely as I should like by here giving definite figures of the relative cost of coal and water gas. Perhaps the best that I can do is to call attention to the great advancement that has been made in the economies of manufacture compared with earlier results. It used to be thought that nothing but naphtha could be used. At the present date, in the best apparatus, crude oils of all sorts, heavy "gas oils," "intermediates," and other distillates are used with the highest economy, and quite as a matter of course. Crude Lima oil is especially noticeable; sold at a price averaging half the price of naphtha, it is used with fully as great efficiency, and with a saving of the loss from evaporation, and the removal of the element of danger; points that it was impossible to eliminate in the use of naphtha. Some time ago a yield of 5 candle power to the gallon was considered as good work as could be done. To day a yield of over 6 candle power is frequently attained. Some years ago it was thought impossible to satisfactorily use coke. To-day it is used as a matter of course, with results about as satisfactory as anthracite, as already referred to. Formerly 50, 60, and 70 pounds of fuel to the 1000 in the generator were common figures, even in large works; to-day such figures, except in the very smallest plants, on intermittent makes, are considered wasteful in the extreme, 30 to 50 pounds being present practice, according to local conditions, etc. In capacity single generators were formerly not built to make over 400,000 to 500,000 each per day. At present generators of twice that capacity are common, and apparatus now in course of construction for the Consolidated Company, of New York City, is designed to generate 1,500,000 per set, or at the rate of 75,000 per hour.

Now let us summarize the points that I have touched upon.

I think from the evidence that I have quoted and the authorities that I have referred to that in regard to water gas it may now be fairly claimed:

That it has ample odor; that it is not heavier than air; that it does not stratify; that it is a safe gas to use; that it is no harder on meters than coal gas; that it condenses no more than coal gas; that the effect of its somewhat greater density can be readily offset if desired; that its light diffuses full as well as coal gas; that it does not require a change of burners; that the oil question is to be but little feared; that it is not dependent upon anthracite; that compared with coal gas there is but little residue; that what little there is, is readily disposed of; that the cost of purification is not especially different; that no more expensive labor is required; that no danger need be apprehended from storage of oil; that existing boxes, holders, etc., are all sufficient; that the amount of water necessary is no greater than in coal gas. And that it has been still further shown as points *distinctly in its favor:* That a much higher candle power can be made; that it is the best enricher; that it can be made much more quickly than coal gas; that it requires less holder room; that it requires less yard room; that it requires less coal storage room; that in combined works it maintains price of coke; that it causes less trouble from naphthaline; that it is the best system as a preventive of strikes; that the gas-house is much cleaner; that fire-brick repairs are less; that Sunday labor and night work can be dispensed with; that it is a point of protection against competing companies; that it is the best gas with which to compete with electricity; that the apparatus is cheaper per volume of gas made in large works; that more gas is made per man; that the strain on the manager is less.

So much for the "pros and cons" of the case. I leave it to you to decide from the above showing on which side is the balance of favor. Where water gas is the cheaper to make it is obviously ahead, and where the costs of coal and water gas are equal, or practically so, is not water gas unquestionably the better one to make, from the showing above? The firearm simile is again a good one. Few men nowadays think of buying a muzzle loader. Why? Purely because it is out of date, has been distanced, and because the modern breech-loader does the same or better work with a great deal more ease. So it is in gas manufacturing. Benches and generators both make gas, but the superior quality of water gas, the great flexibility of its manufacture, and its many accompanying good points over coal gas, stamp it as the "breech loader," or the modern method of making gas. The figures of water gas works now in operation are ample proof of it. I have recently had occasion to make a careful enumeration of all the plants in the country, and I find that within a period of about 15 years over 450 have been erected (and I do not count in this separate sets erected in the same place). Of this number probably 400 are in active use, the balance being early plants that have been superseded by later and better forms. For an industry as new as water gas in its commercial side, and the experiments and the number of processes that must necessarily be tried in any new thing, I think this is a remarkably good showing.

Many of the larger cities have several forms of water gas plants operated by one company, and hence the above number of plants should be reduced by about 50 to give the number of companies; in other words, about 350 companies are to-day using water gas either in whole or in part, and as the very largest are included in this number it is computed that fully half of all the gas made in this country is water gas. New York City, for instance, probably consumes of it, in one night, about three times the amount of *all* the gas made in the State of Ohio in the same time. Every foot of gas now made in Chicago is water gas. Philadelphia, Brooklyn, Boston, and all the larger cities make large quantities of it, and so on *ad libitum*.

That is the verdict of the country at large. That is why I read with surprise some of the out-of-date opinions expressed at the last meeting of this Association, and why I object to their going on the records unchallenged as the sentiment of this Association on such a live topic, and that is why I have herein trespassed so upon your time in endeavoring to give you a fairer impression, and what I believe to be the real facts, in "A consideration of the arguments for and against water gas in 1891."

Discussion.

The President—The paper read by Mr Shelton is certainly an interesting one at this time. We shall be glad to hear from any member, either in favor of or in dispute of the claims made by Mr. Shelton.

The Secretary—After having waited a respectful length of time for some one else to open the discussion, I would like to ask Mr. Shelton if it is not a fact that the area of the flame from an ordinary open burner is much larger in an 18-candle light from coal gas than in an 18-candle light from water gas? Does not the larger proportion of light carbureted hydrogen in the coal gas make the flame larger and, therefore, of more diffusive power?

Mr. Shelton—A pretty large subject is that of flame areas and diffusibility, and all the points pertaining to it. I cannot here give as complete an answer to the question as I would like to do. The area of the flame has a great deal to do with the diffusibility of the light. One of the great faults of the electric light is that the light from, say, the arc light comes practically from a point or a surface perhaps no larger than a candle flame, and that is one of the chief reasons why it appears to have a lack of diffusibility. The spreading of the light-giving surface over a large area is a desirable point to be attained. It is very readily illustrated by the fact that if you could have a room painted with a phosphorescent paint you would have a complete diffusion of the light throughout the room. Therefore, I think that large flame areas are better than small. I cannot answer the question asked definitely. I do not happen to know the exact difference in the area of coal gas and water gas flames for the same candle power.

The President—I would mention that the subject of flame areas, and the diffusibility of light emanating from any source, was gone into pretty thoroughly in a paper read by Mr Humphreys in reply to a paper read by Mr. Boardman (read at the New York meeting of the American Association, 1887) and entitled: "Candle Power *versus* Illumination." Professor Morton made some further remarks on that subject, and clearly showed that the difference in the size of the flame areas of water gas and coal gas cut no figure at all in the illumination of a room and the diffusibility of the light.

Mr. Shelton—I have referred to the paper just spoken of on page 9 of the paper just read. The question about the diffusibility of light has been rather a mooted one, especially in the earlier days. The opponents of water gas said that water gas might be a pretty good light, but that it was not as good as coal gas; that it would not give the same light because it had not the same "diffusibility." That claim was made without any very good basis for its existence. Mr. A. C. Humphreys finally took the question up, and made some very interesting experiments. He took coal gas and water gas of the same candle power, and also water gas of a high candle power, and then made tests with the Welsbach light, which was as much whiter than water gas as water gas was than coal gas. He also compared coal gas with the Welsbach. He went into the matter at great length, and full details of his experiments are given in his paper. Any of you who are in doubt upon the subject would do well to look up the paper for your own satisfaction. The conclusion drawn by Mr. Humphreys, as stated on page 9 of my paper, was: "These experiments conclusively prove that the white light is diffused exactly as well as the yellow, there not being a partical of difference in favor of either. These are facts beyond which we cannot go."

Mr. Cantine—I am well aware I will provoke a smile all around by saying anything on this subject. I have been running a water

gas and a coal gas apparatus combined. I tried the former by itself and was not eminently successful. It was not what the boys call a "blooming" success. Perhaps the fault was not so much in the apparatus as it was in the parties who sold it to us. They were so anxious to make the sale that they were willing to recommend anything and we found after using it for four months that we were pretty badly "in the soup." This paper of Mr. Shelton's is so ably gotten up, and covers so nearly every point, that it is pretty hard for any one to find fault with it, or to attack it. Its fortifications are put up with great care. There is not an angle that is not mounted with a good gun, and a breech-loader at that. There are one or two questions, however, that I would like to ask him. He says coke answers quite as good a purpose as coal, but I tried the Connellsville coke against the best Lehigh coal, and made the most gas and better gas with the coal than I did with the coke. I think the making of water gas depends largely upon the condition of the fire. If it is loose and shallow you do not make as good hydrogen gas as you would with a better fire. I am satisfied from personal experience that coal does the best. I did not take the word of the man at the works, but worked at the cupola myself. That part I think I am right in. However, Mr. Shelton has had more experience, and I would think that what he would say on the subject would be final. I would like also to ask him if he thinks an ordinary gas man could make a perfectly uniform gas by the water gas system; whether or not the density of the atmosphere would not have greater or less influence upon it. The melters of metal will tell you that they can heat the cupola for melting metals very much better on some days than on others. I think that on yesterday we could heat the cupola very much better than we can to-day, as the density of the atmosphere was several pounds heavier then than it is this morning.

Mr. Shelton—I am much obliged to Mr. Cantine for the nice way in which he has spoken of the paper, and I certainly cannot refuse to answer his questions. On the contrary, I expected to answer a number of questions in this soft coal region, and I am glad to give any information in my power in regard to this matter. Referring to coke, I think both Mr. Cantine and myself are right. In other words, you will find that in the paper I state that any apparatus *properly built* will do as well on coke as on coal. But the distinction comes in here: you can work very satisfactorily with hard coal with a comparatively shallow fuel bed; but if you have a shallow bed for coke the fire is so porous that you cannot get as satisfactory results. In using coke to get most satisfactory results it is necessary to have a deep fire bed. So I would say that with any form of apparatus that has a shallow fuel bed I do not think you can use coke as satisfactorily as coal, but with generators of considerable vertical depth the practice is to use coke or coal indiscriminately. If there is 25 cents per ton difference between the price of coal and coke it is enough to throw the balance either way. You may not make quite as much per day in a day's run, but that depends largely upon local circumstances, and I do not think it has yet been determined what is a fixed percentage of difference with regard to the difference due to the density of the atmosphere. I must confess I have come out here to learn something quite new. I have never found that point before as making any appreciable difference in the make of gas. I think it would be a hard question to determine exactly. It certainly does not show on the books, and that is what we are after mostly. Your President wants me to say that in heating our water gas apparatus we are not dependent upon the natural draft as we use an artificial substitute. The only possible difference would come in at the stack outlet, and that difference is so small that I think it would be hard to determine it. We have a blast driven by steam power, and the difference in the density of the atmosphere between one day and another I think would cut no figure whatever. It would be, like Mr. Harbison's figures yesterday, in the thousandths of a cent.

Mr. Cantine—While this subject is under consideration I will state that Mr. Higgins, who has just been elected a member of the Association, is a dealer in oils and naphtha, and as this paper says that Lima oil will do quite as well as naphtha, perhaps Mr. Higgins can give us some light which would be very interesting.

Mr. Higgins—I do not think I can add any information to that which has been given in this paper. Of course there is a vast difference in the opinions of different gas engineers as to the best material to be used. Some records that we have go to show that it is much less expensive to use naphtha than crude oil at present prices. That, however, is something that each gas engineer must determine for himself.

Mr. Faux—In the matter of fuel for water gas plants, only hard coal and hard coke have been touched upon. I would like to hear Mr. Shelton's idea with regard to gas house coke.

Mr. Shelton—We think first rate of it. We use it in many places. I was at a works not long ago where they were running, single shift, apparatus on a make of about 200,000 feet per day, and were using about 30 lbs. of gas house coke from the retorts alongside, which I think you will agree with me is a very excellent result. We have found gas house coke to be just as good as Connellsville, if it is dry, and made from decent coal to start with.

Mr. Faux—I have been using it for a year and a half, and find that I can get better results out of gas house coke than with Connellsville. I have run down to 30 lbs.; on one or two occasions a little bit below that; but at the same time when using gas house coke, I am very careful to pick good coal.

The President—I can contribute a word in furtherance of the statement made by Mr. Faux. We started the manufacture of water gas on the improved Lowe process, and had a very large stock of coke on hand, on account of the recent advent of natural gas in our district. The gentlemen who put the plant in had little faith in the use of gas house coke—having used it in other forms of apparatus, but with great waste—and had little faith in its operation in water gas making. In the peculiar form of apparatus which we had we used it with phenomenal success. We afterwards used hard Connellsville coke, but with very poor success. We found if we used soft coke, a short blast would bring the coke to a very high state of incandescence and a short run would reduce it, making nearly all carbonic oxide from the oxygen and water, with scarcely any carbonic acid, and that a short blast would rekindle nearly all of it. When we used hard coke we found that the short blast would not bring it to that high state of incandescence, while a long blast would make the heat in the middle so high as to fuse the earthy matter and make clinkers, and on the next run the steam would quench the coke below, and the next blast would not rekindle it. In fusing, the earthy matters above would run down on the coke which had been quenched below, and it would go out in the clinkers. The percentage of waste was very high with hard coke and very low with soft coke. I was afterwards induced to make an experiment with some coke which was pronounced to be a very soft coke, but among it there was a good deal of hard coke. The soft coke did give good results, but the admixture of hard coke with it was a clear waste.

It has been suggested that during the discussion of this subject we take up question Number 14, which is:

"*What burner, if any, is better than the lava tip for use with water gas of 22 to 25 candle power?*"

Mr. Shelton has said in his paper that it required no different burner in the use of water gas and coal gas.

Mr. Shelton—I do not know, for practical use, all through a city, of any better burner for water gas than the ordinary lava tip. Of course, if we go into the finer points, and take the case of the different densities and different compositions of gases, we would of necessity evolve a burner for each particular gas which would give the best results. There would be as many different kinds of burners as there are different kinds of gases; but looking at the matter from the practical and commercial standpoint, the ordinary burner now in use for water gas of 20 to 30 candle power is the common lava tip. In works that I had charge of I used that burner and ordered them by the gross, just the same for water as for coal gas. The Bray burner also gives good results. I think that practically those two burners are used to the exclusion of all others.

The President—A pertinent remark was made a few days ago when they were offering a new type of burner to a very practical business man in our town. He listened very attentively all through the presentation of the subject, and concluded the talk by saying that in nearly all garrets and in some cellars would be found these improved methods of burning gas; but the lava tip was the one that was commonly used, and he believed that it would be used for a long time to come.

Mr. Thomas—I would like to ask Mr. Shelton if there is any water gas plant which uses only 38 pounds of fuel to the thousand feet of gas prouced?

Mr. Shelton—In the generator, or including the boiler?

Mr. Thomas—Including the entire fuel used for the manufacture of the gas.

Mr. Shelton—Fuel is usually calculated in two parts: First, the generator fuel direct; and, then, the steam-making fuel, which, of course, is necessary in all gas works for holder and other purposes, and differs very much in different works. I cannot here quote a works that is using but 38 pounds, but there are a number of them, for the reason that on the larger plants the generator fuel comes down to the figure I spoke of some time ago, and the steam fuel is certainly no greater than the difference. I have no doubt I can refer to a dozen plants that are running on the figures which I have given.

Mr. Thomas—I hold the opinion that the entire amount of fuel used should be the basis of the calculation. The coke taken up in firing the boilers of a coal gas works is not counted as an asset. I do not know of any water gas plant in this country that is making a thousand feet of gas with only 38 pounds of fuel—that is, taking the boilers, generator, etc.

Mr. Shelton—I think if Col. Thomas and I got together outside that I could show him some; and, now that he calls my attention to it, one occurs to me, that I have referred to in my paper in mentioning the disposition of crude tar. In the use of crude oil there will always be a greater or less amount of tar left, and if that tar is disposed of by burning it under the boilers, you will have very little need of extra fuel for boiler use. The works that I had in mind I am sure is running on less than 38 pounds of coal per thousand feet.

Mr. Thomas—In the generator?

Mr. Shelton—In the generator. Under the boiler they use the water gas tar, and such extra coal as may be needed. By using the tar they bring down the amount of boiler coal needed to about three pounds per thousand feet—that would correspond to the coke breeze used in coal gas works.

Mr. Christian—The plant we run is a small one, and is run intermittently; hence, of course the amount of fuel required is considerably more than it would be in large works. The amount used in those large generators, especially in some of the newer styles, gets down as low as 35 pounds; and as the tar can be used under the

boiler, I cannot see why the fuel should not be reduced to the figure stated. It is a question in my mind whether you can use that tar under the boiler, as I think the expense of getting it in such a shape that it can be used would offset the value of the use of it. Lima oil differs considerably in gravity, and those who can get good crude Lima oil do not make tar of much value. If you are running on 37 gravity oil you can get all the tar you want and probably a little more.

The President—The subject of oils with the results that are obtained with different apparatus suggests to my mind the propriety of asking Mr. Shelton to give us a description of the difference in the design of the apparatus constructed for the use of naphtha and that which is designed for the use of crude oil. If it is the pleasure of the body, and they would not consider it in the light of an advertisement for any particular apparatus, I would like Mr. Shelton to give us a description of the difference in designs of the apparatus constructed for using the two different materials.

Mr. Shelton—I almost wish, Mr. President, you had not asked me that question, because I do not want to bring in here anything in the nature of advertising, either directly or indirectly. I am connected with the introduction of water gas plants; but I have tried to eliminate from my paper as much as I could the fact of such connection. At the same time it is only fair to the United Gas Improvement Company to say that it builds half a dozen different forms of apparatus for itself and for others, and therefore is in a position to judge from work done as to which is the best form for the use of naphtha or of Lima oil. My theory is this: Naphtha is a homogeneous substance, and one uniform heat, if you get the right heat, will take care of it very nicely. That is all very well for naphtha. Now as to the use of crude oil. It is put upon the market very cheap and it is an object to use it. It is not homogeneous. It has all sorts of things in it. Mr. Higgins could probably give a list of fifty. There are the lighter parts, such as benzine, naphtha, kerosene, etc., and the heavier parts, such as paraffine, lubricating oil, and tarry matters. If you have one superheater that you can carry just one heat with, of course that will take care of a part of the oil all right, but it will not take care of the balance. If you carry a high enough heat to make gas out of the heavier parts, then you are making lamp black out of the lighter parts. If you carry a low enough heat to make gas out of the lighter parts, that will not be sufficient enough to make gas out of the heavier parts of the oil. So we worked out the theory and design of apparatus suitable for this oil. We went on the theory that we wanted to *gradvate* the heat, and have an increasing heat for the oil from begining to end. The form that we are now building mostly is one which heats the oil at first to a temperature of 500 or 600 degrees—vaporizing it in short—before it is put into the apparatus at all; then it goes into what we term the first superheater, which is carried at a low heat. That completes the vaporization, and partly gasifies the oil. Then it passes to the main superheater, which is carried at a much higher heat; and that heat is sufficient to gasify the heavier parts of the oil not taken care of in the first superheater. In other words, there are three steps; the low heat at first, the intermediate heat of the first superheater, and the high heat of the last superheater. The crude oil is vaporized and broken up and is partially gasified; then it is passed to the high heat and the gasifying is very complete. The proof of the pudding is in the eating. We have built a great many works all over the country and have all sorts of apparatus in them. We have perhaps a dozen different forms. We have gone into the question with much care, and we find that the form which I have just described gives the *minimum* of tar. We average less tar in that form than in any other. In other words we use the oil up completely by the method of which I speak.

The President—My object in asking Mr. Shelton to give that description was to change, perhaps, an impression which has been expressed by some of the members, that the results obtained by any one apparatus would answer for the results obtained in almost any other form of apparatus using a given material.

Mr. Cantine—Of course Mr. Shelton is aware that every gas man now has great love and admiration for anything that looks like tar. I would like to ask him whether this water gas tar has any particular commercial value.

Mr. Shelton—I am afraid that shows that Mr. Cantine did not read my paper last night as asked, or else perhaps there is so much of it that he cannot remember all that there is in it. I refer to that point in what I say about the disposition of residuals, on page 11. Perhaps I can state it off-hand better than by reading it again. In the early times of water gas making the water gas tar was not considered worth much. Not a great deal of it was made, and no attention was paid to it. But lately the price has appreciated—in some places one could not turn gas-works drainage into the city sewers—and that brought up the question of how to dispose of the tar. It was found that water gas tar makes a very good tar, if you take the water from it. You can eliminate the water by a simple process of settling, by placing it in a tank with a partition in it, with syphons to draw off the water and tar, letting gravity do the work. You can thus take the water out and sell the tar. I know of one place where they get six cents per gallon for the tar, and nine cents at another place. In one place this tar was subjected simply to a concentrating treatment. It made very good pitch, and was used for street paving. The gas company took several contracts for street paving. It has also been reduced further and made into varnishes and paints. There has been no such call for it yet as would bring it into competition with coal tar for the finer purposes, but if there is any call for it, I have no doubt there is very much of value in it. The commercial value now is 6 or 8 cents per gallon, after the water is taken out.

Mr. Thomas—About what would be the quantity of tar per thousand feet of gas made?

Mr. Shelton—From one third gallon to 1¼ gallons for every 1,000 feet of gas made. In the place I speak of, where it was used in street paving contracts, they had an old apparatus, and used crude oil. They made a tremendous lot of tar, and the question with them was how to get rid of it, so they worked it up for street paving business as referred to. The double superheater form of apparatus makes about a third of a gallon of tar to 1,000 feet of gas; water gas plants will run from that quantity up to over a gallon, according to form of apparatus.

Mr. Nash—In the combined plants, is it better practice to let the tar all run into the same well, or to separate it?

Mr. Shelton—I should certainly separate them at first. I would have a separate tank to hold the water gas tar, and take the water out of it first.

Mr. Nash—It does not deteriorate the value of the coal tar?

Mr. Shelton—Not especially, if you take the water out of it at the start. *As it comes out of the machine* it is not as good as coal gas tar. There is no doubt about that.

On motion of Mr. Bate, the thanks of the Association were voted to Mr. Shelton.

Mr. H. Wilkiemeyer read his paper, entitled

IN WHAT DIRECTION SHALL OHIO GAS COMPANIES LOOK FOR THE FUTURE CHEAPENING OF THEIR PRODUCT?

Were I able to give an accurate and definite answer to the above propounded inquiry, I should retire at once from my present field of employment, sell the secret to some gigantic syndicate formed for the special purpose of its purchase, secure a continent or two, and for the balance of my days should make the Vanderbilts and Rothschilds feel their poverty as compared to my wealth.

But alas! I am not able to answer the inquiry in such manner as that the question is fully disposed of, and the aureate vision of untold wealth vanishes like the mist of the morning; for there is no realm of conjecture, or rather thought, so deep as the future price of our product. The wonderful developments in this vast field of scientific exploration, made since the first gas was distributed from coal by Murdock, in England, in the latter part of the last century, warn us that the inquisitive, restless mind of mortal man will never rest until the inmost recesses of Dame Nature's box of wonders have been explored, and her dearest secrets ravished from her closely guarded clasp. We in our profession, as in all others, stand only on the threshold of the great store-house of scientific and experimental knowledge. We are only in the morning of the new day of progress. A century is nothing—a mere bagatelle of time, when scientific problems are concerned. While we think we know much—so did our ancestors in 1700. To our progeny in 2000 we will appear far more undeveloped, more crude and clumsy in our methods and theories than do our remote ancestors appear to us.

But while we are prevented from being accurate in our sciences, because of the undeveloped age in which we live, we at least have the privilege of telling what we *think* we know, and suggesting a course for future conduct based upon our actual experience in the past, which is always prolific of suggestion as regards the future.

The exigencies of the present demand as accurate a response as possible to the question assigned me for answer in this paper. This query is one of the most profound and impressive importance. In all branches of business, agricultural, scientific, manufactural, the great burning question of the hour is, "How shall we cheapen our product? How keep pace with the times? How keep from falling a straggler to the rear in these rushing days of forced and rapid marching?"

The success of all modern business institutions depends wholly upon the cost of production, covering, in our industry, all the multifarious complications pertaining to the manufacture and distribution, as well as the financial, clerical and mechanical management and policy of its administration. It is impossible in the limited scope of a paper of this character, nor would it be policy, to examine into the merits of this or that process, or delve deep into a scientific dissertation on the question of coal or water gas, which, while it might not be a digression, would involve me in a labyrinth of figures and ideas from which it would be impossible to emerge without the danger of being charged with an object entirely foreign to my purpose; besides which objection arises this other and more important one, that every one in this audience has given this subject much careful thought and study.

As in telescopic, microscopic, mechanical and agricultural fields of labor, the best tools and implements are conducive to the most successful results, so in the manufacture of gas must our attention, first and foremost, be devoted to our apparatus. The astronomer makes more important discoveries with the most improved instrument of his science. The delver into the mysteries of nature advances more rapidly with the assistance of the latest and most powerful adjuncts of his profession. The modern mechanic with his kit of fine edged tools produces wonders in comparison to our forefathers, whose sole implements consisted of saw, adz and auger. The tiller of the soil coaxes more bountiful harvests from old Mother Earth with modern machinery than did his ancestors who

merely tickled the surface of the earth with their wooden mold-board. So we of our craft must look at improvement in mechanical methods for a cheapening of our product.

The construction of our plant must be improved in many directions, and the majority of the small gas works of this State, where they are still of the primitive pattern, must be entirely reconstructed. In many places we still continue to use the old style furnaces, which consume from 50 to 70 per cent. of the coke made. With these the heats cannot be carried sufficiently high or uniform to distill the coal properly, and cannot carbonize the quantity the later and more improved settings accomplish with even less energy exerted. The condensation is very imperfect, stealing constantly a great percentage of candle power, causing the formation of naphthaline, trouble at the purifier, and even in some instances carrying the condensation to the meters.

Circumstances will determine where a water gas plant is the more economical, and where to-day coal gas is manufactured more cheaply by reason of the prices paid for coal, the cheapness and reliability of labor and the receipts from coke, tar and other residuals, the situation may, perhaps, be changed before another sunset. But in either case the plant, whatever it may be, must be of the most improved character. The best is always the cheapest. The plant must be constructed in such a way as to require the very minimum of labor, repairs and attention, and all parts so constructed as to yield the greatest results in quantity with no loss to quality. Our duty is not only to make the greatest quantity, but it is due also to our consumers to give them the very best quality. The street mains are still, in many instances, of the same size as when the works were first constructed, thirty or forty years ago, when the war of light was between beef-tallow and whale-oil, and coal gas was only for the use of those with plethoric pocket books. Now the increased demands are supplied through the same narrow channels. Gas is sent to the meter by increased and excessive pressure, causing ruinous leakage to the company and inferior treatment to the consumer. Our plants, therefore, must be improved; the latest and best discoveries giving us the greatest results for the capital and capability employed; and as these varied improvements are made we should not sit secure in the present. The future demands our attention.

Now, having pointed out the first desideratum, to-wit: the improvement of our plants, in what other direction, to what other means, must we look for a cheapening to us of our product?

We already have a fine plant. The next important desideratum is good clerical help, sufficient intelligent labor, and, above all, effective, certain, skilled and intelligent management. No man, or no corporation, ever lost a dollar by having the best material that money can buy. Our managers have no more certain means of improvement at hand than that to be secured from a constant and regular reading of periodicals devoted to our interests. Meetings such as this are also sources of incalculable benefit. They are co-operative in their working—each obtains the benefit of the knowledge of all the rest of the members. Here we pool our knowledge; and the dividend, the pro-rata share of each stock-holder in this "knowledge pool," is often much larger than his contribution.

We who have the management and control of this vast and important interest must ever be on the alert. We must be unslumbering sentinels. We must devote ourselves with enthusiasm to our interests, with an assiduity amounting almost to self-sacrifice, else will we be surpassed by other branches akin to our industry,—else will we become laggards in the rear of progress and representatives of a declining industry. Given the best of construction, the best of labor, and the best of management, in what direction then must we look? Why, surely to an extension of trade.

We must aim to make gas not only fashionable, but we must make it a necessity. If we cannot make the use of it universal we can at least prevent its use being made a mark of distinction. We must popularize the use of gas, especially where it is not a necessity. We have many hidden friends aiding us. For instance, the insuranc companices, and even the State laws. nsurance companies and other agencies have so firmly established the fact that gas is more desirable and safer and cheaper in the end, especially where health, cleanliness, convenience or safety is a part to be considered, that the direction to which we must look for expansion of trade must come from a locality wherein these agencies cannot assist us.

To make a comparison of our business with others is next to an impossibility. The hotel business, as regards profits, is more nearly akin to ours. If a hotel is patronized to the extent that it is on a paying basis, then if, by "hustling," etc., six, ten or a dozen extra guests are secured at any one time, the money these people turn over into the coffers of the Boniface is, I may say, almost clear profit. In our own business even only a small increase of gas consumed cheapens the cost of the total production. Every additional dollar's worth of gas sold after the plant is on a paying basis goes to cheapen the cost of the production and to increase that most desirable of all things—the dividend.

As it is now, statistics demonstrate the fact that private residences throughout our State now consume, through gas stoves alone, 625,000 cubic feet per day, or 235,000,000 cubic feet per year. The gas engine demands at the present time another 127,000 cubic feet per diem, or 40,000,000 per annum, making a total of 275,000,000 cubic feet for fuel and power—sufficient work now for fifteen or more small gas works. Gas for fuel and power is comparatively a new source of revenue to us. We have all made some effort in this direction, and with the good results noted above. Suppose we follow the plan of every other business enterprise outside our own, and adopt some of their methods, the principle of which is energetic, systematic and intelligent canvassing. The "drummer" is by no means a modern institution. Every important discovery has been the result of an effort to extend commerce and trade. Christopher Columbus was the first drummer known to have set foot upon American soil. He (the drummer is the advance guard of progress. He is the mainstay of the manufacturer. There is a certain amount of old-fogyism still extant which makes men apt to be satisfied with their present surroundings; but when the glib-tongued, agreeable introducer of some meritorious article steps into the arena he is likely to work a great change in the ideas and views of the person whom he assails. He often takes him by storm, and then the willing victim surrenders without knowing it. Every industry is now represented "on the road." The agent of the grocer calls at your door with samples, and often induces you to buy what you did not know, until his advent, that you needed. There is nothing like push. There is nothing like persevering efforts in praising and selling your commodity, whether it be dry goods or gas. It would be a good idea for us to employ men who could advance our trade by their own peculiar genius as advancers of other men's trades and interests. Let us have men who can talk gas by the year, show up the advantages of its use, and our output will be increased far beyond our most sanguine expectations.

Should we be situated so that we could not employ the man "on the road," we ourselves should and must hasten to adopt his methods, and adapt *ourselves* to fill his place. We must be up on all points, modes and methods universally employed in competitive business, come hourly in contact with our patrons, and the rough usage we may receive at times should only hasten to fit us and bring out within us the energy, polish and tact we surely will be compelled to employ in our profession in the near future. We must broaden out and come up to the standard business man. This would have sounded ridiculous to the founders of our industry, but we live in different times. The present demands much that was unnecessary in the past, and the future will require still more. Prepare yourselves now—do not delay one moment. Look back but eight or ten years—what changes have not taken place? What demands have not been made on us since then?

We must, like all other business men of the day, advertise our goods. Advertising not only gains the good will of the press, but takes us out of the attitude of monopolists and places us upon a level with other merchants, whose situations are equally respectable but who are compelled to solicit trade. It brings you nearer the people. Contact brings acquaintance, and acquaintance brings customers. It will produce a sort of brotherhood of feeling, and will enable you to accomplish many desires which are now well nigh impossible of accomplishment except by means distasteful to us in their nature and tendencies.

Again, the universal applicability of gas for all sorts of mechanical purposes should be better made known. To the small manufacturers, whose needs for motive power are irregular and intermittent, gas is a most valuable article. This fact has been demonstrated beyond any doubt in the printing offices of the land. It is demonstrated to the nicety of an algebraic theorem that the convenience and economy of a gas engine in comparison with steam or man power are two to one in favor of the former. In a comparison of the two we have nothing to fear. We have every advantage on our side, and all we have to do is to demonstrate the fact to others.

But where constant power is needed we have as yet done but little. The gas engine has reached that degree of perfection which leaves but little room for improvement, and it, with only a half-way effort on our part, will assist us very materially to make a harvest. You need no licensed high-paid skill to run a gas engine. It runs itself, and the item of saving in repairs alone is a large one. There is no danger from neglectful firemen. The feeder of a gas engine is ever vigilant, sleepless and watchful. He knows no fatigue. He is always at his post of duty, always carries the same pressure to the engine, and he will not let the water get low, nor will you ever wrestle with a foaming boiler.

Let us continue to work for our better knowledge of our own craft. Trade a good idea of our own for one equally valuable of your neighbor. Make strong every weak point, and rest only when the best methods are found. We must not be satisfied with the present. Because we now make a pound of coal produce five feet of gas is no good reason why we should stop, but should be an incentive to urge us on by individual and collective effort to get six feet and more, with an eye always open to increase our candle power at the same time. In the minds of the men present is a veritable bonanza of valuable knowledge on the subject of cheap manufacture of gas if it could but be separated and codified for the use of us all.

It is an unpleasant but, nevertheless, always a present fact that gas companies, as a general thing, are not popular with the public. To a great extent that is our fault. We have had a monopoly in a certain sense, and monopolies and men connected with them are not apt to court public favor or the favor of the individual. The man you "bluff" to-day may become a councilman at the next Spring election. Let us not be too prone to rush into politics. We should avoid public prominence. We should not seek political preferment for self or friends as a means of intrenchment. The American public is eminently fair, but it is not in favor of men holding office for the furtherance of their business projects. You can do more good for yourselves on the outside than on the inside

of the city council. Don't try to be boss Make yourselves strong by being liberally generous in all matters concerning the public good, and never inflate yourself with your own product to the extent that will not allow you to open your eyes when you meet a customer. In your financial capacity avoid strifes, and above all and by all means see to it that your clerk makes no errors which are hard to explain to consumers.

In conclusion I will say that these ideas, in comparison with the magnitude of the subject and the range of possibilities in the suggested directions, are few and desultory. Yet their general adoption and following out is but a question of very little time.

The three things, therefore, most necessary in the furtherance of our interests—the future cheapening of our product—are:

First—The improvement of our plants.

Second—More intelligent and scientific management; and

Third—An extension of our trade in the avenues, and by the means, to which I have in my feeble way called your attention.

Let us all strive in unison to help each other by a division of our knowledge, and stand shoulder to shoulder in our praiseworthy efforts to advance our trade, and ere long the problem as "to what direction gas companies of Ohio must look for a cheapening of their product" will become a common secret to us all.

Discussion.

Mr. Printz—Wilkiemeyer always reads a good paper, but I think this is the best of all. I have to thank the secretary for his consideration in placing my name ahead of Mr. Wilkiemeyer's on the reading list. He has not only covered his own subject, but has entirely taken mine in. My feeble effort of yesterday would have had no place at all if read to-day.

Mr. Wilkiemeyer - One good word deserves another. When Mr. Printz read his paper yesterday, I made up my mind that I would see if we could not arrange to have no meeting yesterday evening in order that as much time as possible might elapse before the reading of my paper, so that the ideas expressed therein would have some little weight, because they are on the same points and are about identical with his.

Mr. Penn—I agree with Mr. Printz. I think it is one of the best that Mr. Wilkiemeyer has written. I wish to speak with regard to the gas engine. I am surprised to hear some gas men say they have only one or two gas engines in town, and only a few gas stoves. There has been in this respect a large increase in number in nearly all the towns of the State, as compared with a few years ago. We now have in our little town six gas engines. All our newspapers are printed by gas. While speaking about the press, I may say I am in favor of advertising our business largely, and letting the people know what a good thing gas is. I have tried to introduce it both for heating and cooking purposes. I have sold quite a number of heating stoves during the last year—more than ever before. In the last two years my percentage of increase in cooking and heating stoves has been over 100, and it has materially helped us in our output. When they put in the electric light our output figures were cut down somewhat (in the fore part of last year), but in the latter part of it we made a gain of over 20 per cent., and I think that the increase is largely due to the day use of gas. We should get as much gas used in the day time as possible, as that will help to cheapen our product.

Mr. McCook—I agree that Mr. Wilkiemeyer not only reads a good paper, but he reads a good paper well. Has anybody gas stoves in use where there is natural gas? We have not in our town, and we do not want to tackle gas stoves until the natural gas gives out. There are no gas stoves in our town at all.

Mr. Cline—I would say, with regard to Mr. McCook's remarks and to those of Mr. Penn, there are some other advantages that natural gas gives to a town besides taking the odium off of the artificial gas company. We went to a large expense to get out a great many gas stoves—some 300 or 400 I think—when along came a natural gas company who turned their gas right into these stoves and thus spoiled our day consumption.

Mr. McCook—How do they sell it down your way?

Mr. Cline—By meter.

The Secretary—One point in Mr. Wilkiemeyer's paper commends itself to me especially. He says: "We already have a fine plant. The next important desideratum is good clerical help, sufficient intelligent labor, and above all, effective, certain, skilled and intelligent management." I think a gas company can afford to hire the best man that can be found to manage their business.

Mr. Sherrard—I regard the suggestions made in this paper of as much importance to us as those of any paper that I have ever heard read before this Association. One point in it I think is particularly well taken, and that it would be well for us to dwell a little upon it, to consider it, and possibly draw out some experience of our own with regard to the following suggestion of Mr. Wilkiemeyer: "It is an unpleasant but nevertheless always a present fact that gas companies, as a general thing, are not popular with the public. To a great extent that is our fault. We have had a monopoly in a certain sense, and monopolies and men connected with them are not apt to court public favor or the favor of the individual. The man you 'bluff' to-day may become a Councilman at the next Spring election. Let us not be too prone to rush into politics. We should avoid public prominence. We should not seek political preferment for self or friends, as a means of intrenchment. * * * Make yourselves strong by being liberally generous in all matters concerning the public good, and never inflate yourself with your own product to the extent that will not allow you to open your eyes when you meet a customer."

I want to say that that is well taken. Heretofore, in the eastern part of Ohio, the gas companies, so far as I know, and every man connected with them, shrank from asserting probably what they ought to do; and the result was that we failed in the responsibility of asserting our rights and performing our duties. I can best illustrate that by citing an experience in our own town. Three years ago we made up our minds that in our town, as in others, we must keep up with the progress of the times—that in place of relying upon gas as a means of lighting the streets of the city, we must prepare ourselves to be ready to furnish any kind of light that might be desired, either the arc light upon the streets or the incandescent lights in the stores. Immediately upon our commencing, we, being a gas company established way back in 1850, another company in the town started to put in a plant, very cheaply constructed, for the purpose of furnishing just what we were preparing to furnish in the near future, and on a larger and better scale. This company was started by citizens of our own town. Naturally, as we had been the monopolists of the town, it was fair to infer that we were going to meet with some opposition in our Council, and that this new company, composed of citizens who invested their money, would be more likely to receive favor from the Council than the old company that had been the monopolist for 40 years. The plant was built. It was started. The main squares of the city were lighted with arc lights, furnished by this new company, before the old gas company got ready to supply the city either with arc or incandescent lights. They were alert, as young beginners, to see that the members of the Council were men who would favor their side. That began to wake up the old fogies in the gas company—of whom my friend, Mr. McCook, is one.

Mr. McCook—And the oldest.

Mr. Sherrard—Yes, and the oldest. This began to wake him up to a sense of the propriety of his doing something. With the aid of some of the younger members of the company, like myself, he succeeded. He went out upon the streets and talked with the people of the town. He showed them, first, that we had not been monopolists, but that we had regularly come down from $3.50 per thousand, first charged by the company, until we were now furnishing gas for $1.50 per thousand, and upon payment being made within a given time, took off ten per cent. from that. Further, that we were willing to abide by every order of the Council, either in extending our mains or in reducing the price. It had a very good effect. People began to see, after we had opened our mouths to them and explained things, that we were not exactly the character of people they imagined we were. To make the story short, some of the members of the Council who were inimical to either the new plant or the old gas plant, conceived the idea that the *city* ought to be the monopolists, and that it ought to build a plant for the purpose of furnishing electric light to the citizens. Various schemes on the part of three or four members of the Council were adopted, and strong recommendations were made, and it came to be a pretty solemn question as to whether the gas men, who were, as I say, preparing to furnish arc, incandescent and commercial lights, would not be snowed under by those inside the Council. But they only hold office for two years, and some of them were about going out. The old gas company, of which my friend Mr. McCook is the senior member, and one of the largest, conceived the idea that some of these men ought not to go back to the Council; and while he did not make himself obnoxious, he showed the people we were preparing to spend from $75,000 to $90,000; that we had already expended considerable money in making preparations, and that we were, as citizens, paying our taxes to them, buying the material and employing labor right in our own town, and that it would be unfair to the old plant for the city to come into competition with its own citizens. Mr. McCook succeeded in keeping some of the members from getting back into the Council. That is to say, he and his friends succeeded. After the matter was started, and after my friend had expended some of his energy in the town, in the way I have described, other citizens took the matter up, who relieved him entirely, so that he could take a back seat. They took his place. The result was as stated; and then we were enabled and emboldened to go before the Council to explain exactly the situation. We had great opposition at first; but, in the way pointed out by Mr. Wilkiemeyer in his paper, we went to work. We did not begin by asking to have ourselves made members of the Council, nor did we ask places for our friends. We ought to keep back all the friends of the gas company from becoming obnoxious in the way of being even candidates for office. We expected thereby we would stand a better chance with reasonable minded men in the Council, if we were independent and entirely aloof in politics in that sense. We have succeeded. We have a contract—not a very good one, but the best we could get. We have almost the entire unanimity of the Council; and by another year, if my friend keeps up the same energy that he has displayed in the past, I do not doubt that the entire body will be friendly toward us. We depend not alone on his individual efforts, but on the individual efforts of the friends we have made in this way in our city. Now we have a contract and we have the best of feeling in the Council. I believe that all but two members of the twelve would be willing to do almost anything in reason for the present gas and electric light company.

Mr. Nash—I would like to hear Mr. Harbison state his methods for getting the right side of the Council. Mr. Wilkiemeyer says

you can do more good for yourself on the outside than on the inside of the City Council. I think, from what Mr. Harbison said yesterday, that he believes it would be a good plan to have a little influence inside.

Mr. Harbison—That is a matter which is open for discussion, and as to which there might be a difference of opinion. I have found at times that the "outs" were in more trouble than the "ins," and I have always noticed that the "outs" were struggling to get "in." In most cities you have two boards—a board of aldermen and a council, as we have with us—and my experience has been that if you have one or two good men in either board who know what they are talking about, they can, without making enemies, do you a great deal of good. I have found it just as hard work to educate an alderman or a councilman as to correct ideas in gas matters as it is to educate a lawyer to plead your case for you before a legislative committee. You wish there was no such thing as a lawyer when you go before a legislative committee, but wish that you could plead your own case. There is something about the gas business that is different from any other industry that I know of in th t respect—it is not to be expected that you can take a layman and educate him in all that he ought to know when he comes to plead your case for you. Our experience in Hartford seems to teach that it is of great advantage to have some one in either board who knows what he is talking about when he gets up to speak, who has the courage of his convictions, and is able to tell them without putting it in an offensive manner. It is not necessary that a man should antagonize the citizens of his town simply because he is a member of the board and is interested in the subject of which he speaks. They know you are interested—in an ordinary-sized town or city everybody knows what the other man's business is—and if he stands up in the council to say a word, if he is not connected with the gas company he is still accused of being in their interests, especially if there is any opposition to the company in the town. I am decidedly in favor, from my experience of having someone who understands your wants and what your object is in attempting to do business in the town, who is able to stand up and defend you when charges are make. I want no ignoramus there. A good many of the latter stamp get into the councils and aldermanic boards of cities, who succeed in getting in because they can manipulate a certain number of votes. They are "on the make" always; and it would tire a man very soon who is managing a gas works if he had to make friends of such men in the only way in which they want to be made friends of; for they are perfectly willing not to have the left hand know what the right hand gets. I believe that in our place we have been saved more than once from serious trouble by having an advocate inside of the board who could quietly and intelligently reply to any unjust statements made, and intelligently answer any questions put to him on the subject. I am of the opinion that the public generally simply need to know the facts in the case, to know that a gas company is doing its duty fairly and honorably by its patrons, to make them willing to support it. There are always a few extremists in every place whom it is difficult to satisfy—they do not want to be satisfied—but the mass of the people are reasonable, if we approach them rightly and treat them as if they had some rights which even a gas company was bound to respect. I believe, on the other hand that gas companies have rights which are worthy the consideration of the most humble citizen, as well as of the most enlightened. I think that, as in the other kinds of business, if you treat your people well they will treat you with proper consideration. Treat your customers politely when they come into the office, and if they have a grievance, real or imaginary, give it careful attention with all the promptness that you can. Know yourself what is required in providing a good light for your customers. They are not posted with regard to what they need, and so you have to educate them. None of the details, in my opinion, connected with the manufacture, distribution and consumption of gas, are so small that it is not the duty of the gas company, through its representative, to explain. Be sure you understand these details yourself to begin with, and then make them plain to the people. I do not think it any condescension on the part of a gas manager, or beyond what he ought to do, to intimate to a consumer the proper way to burn gas. If he notices, as he passes by a store, a poor burner in the window, he should not be so proud that he desires to look at a stylish carriage on the other side of the street. No; he should tell the proprietor that a burner cleaner run through that burner will give him more light for the money he is spending; that a clean burner will not consume any more gas, but will give a better light. He will thank you for it and will think kindly of you. By looking after these minor details you will find good results following in the course of the year.

Mr. Cantine—In connection with this paper of Mr. Wilkiemeyer's is one thing that I wish he had touched upon. It occurs to me now that there are but few companies in this State that are insured. In the cheap manufacture of gas, it would be rather necessary, I think, as in all other business, to put ourselves on a safe basis. I do not know how many of you carry insurance, or how many of you think you can insure yourselves cheaper than you can get anybody else to do it. The farmers in the townships of Ohio have some very good insurance companies; and it occurs to me it would be well to think this subject over, to determine if the gas companies of this State cannot advantageously organize mutual insurance companies (including the electric light companies) and thereby protect themselves against loss. All the insurance companies that called upon me with a view to get insurance always regarded our plant as being a sort of powder magazine that they had better steer clear of. We found that insurance would cost us from 1½ to 2½ per cent., depending upon the solidity of the insurance company.

The President—The subject of insurance of gas works was taken up by our Company. We made inquiries of a number of the large companies in Ohio and outside of it, and found the practice to be not to insure. In their opinion the liability of loss by fire was but nominal, and the rates, although not exorbitantly high, were thought to be higher than the case demanded; and the practice was for each company to be its own fire department.

On motion a vote of thanks was passed to Mr. Wilkiemeyer.

(To be continued.)

Hydrogen and Oxygen Produced by Electricity.

In a paper recently read before the Societe Francaise de Physique, Commander Renard described his investigations on the electrolysis of water on a commercial scale, which he commenced as far back as December, 1887. Taking the counter E.M.F. at one and five-tenths volt, and the total plant efficiency at only 50 per cent., thirty-five and three-tenths cubic feet (one cubic meter) of hydrogen can be produced for every ten horse power hours; and taking the coal consumption at two and two-tenths pounds (one kilogramme) per horse-power hour, the cost of fuel for every thousand cubic feet at atmospheric pressure of the mixed gases comes out in France at between 32 cents and $1.20, according to the price of coal.

To make the electrolytic production of these gases a commercial possibility it is necessary to avoid the use of costly platinum electrodes and of air-tight partitions for collecting the gases. Commander Renard employs an alkaline electrolyte (caustic soda, thirteen per cent. solution) and is therefore able to substitute cheap cast iron electrodes for platinum. As to the vessels for the collection of the gases, he finds that so long as they have a *capillary reaction*, however incomplete, equal to a few centimeters of water, the hydrogen and oxygen do not mix. Commander Renard employs porous pots of asbestos fiber, which are able to withstand a pressure of from thirty to fifty cms. of water without permitting the passage of the gases.

The actual commercial apparatus used at the Chalais works is as follows: A large cylinder of common sheet iron serves at the same time as the containing vessel for the electrolyte and as the negative electrode. The positive electrode is a perforated iron tube, fixed on to an insulated lid, which fits hermetically on to the top of the containing vessel. This electrode is surrounded by a large asbestos bag. Two voltmeters of this kind have been in continuous work at Chalais for some six months, and at the end of this period both the electrodes and the asbestos bag were in perfect condition. The gases given off are pure, and there is no ozone. According to Commander Renard, a battery of 36 large voltmeters could generate about 200 cubic feet of hydrogen and 100 cubic feet of oxygen per hour, which could be compressed to a pressure of from 120 to 200 atmospheres in steel tubes, and utilized for therapeutic, laboratory, metallurgical, and other purposes. The *total* cost of these gases, ready for use in steel bottles at a pressure of 120 atmospheres, when produced on a sufficiently large scale, is estimated at from $2.92 to $3.54 per 1,000 cubic feet.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

At the annual meeting of the Gettysburg (Pa.) Gas Company the following officers were elected: Directors, Prof. E. S. Breidenbaugh, A. D. Buhler, S. R. Russell, Edward McPherson, H. J. Stahle, M. Eichelberger and J. M. Walter. Professor Breidenbaugh was chosen President.

Application has been made for a charter incorporating the Peoples Gas and Light Company, the organizers of which propose to distribute gas and electric currents in the city of St. John, New Brunswick. The Company is capitalized in $800,000, and the provisional Directors are: Charles E. Spiers, of D. Van Nostrand & Co., New York; Urzal O. Crane, iron merchant, New York; John B. Stewart, New York; E. H. Potter, New York; George Cook, Brooklyn, N. Y.; and W. T. Whitehead, of Fredericton, N. B. Owing to the following peculiar form of paragraph "*d*," of the articles of incorporation, we imagine that this is but a scheme to take over and consolidate the present gas and electric lighting interests of the city. The paragraph referred to is: "To purchase, lease or otherwise acquire the whole or any part of the property and franchises of, or to amalgamate or enter into any working agreement with any other Company incorporated for gas lighting or electric lighting or power purposes having authority to so contract."

The betterments on the Peoria (Ills.) gas works are well advanced, and the next thing to be taken in hand is the street mains, which are to be thoroughly overhauled.

Richard Beckett, who for 30 years served the Cambridge (Mass.) gas works in the capacity of foreman, died at his home in that city about a fortnight ago. Mr. Beckett, who was in his 59th year, was deservedly esteemed by his employers.

THE stockholders of the Oakland (Cal.) Gas Light and Heat Company have assented to an agreement under which the bonded indebtedness is increased from $350,000 to $1,000,000, the California Safe Deposit and Trust Company to hold the same as Trustee. Important improvements are to be made on the gas works, and on the electric lighting station as well. The Company will also erect a handsome building for office purposes.

AT a meeting of the shareholders in the Millville (N. J.) Gas Light Company, the following officers were elected: President, Francis Reeves; Secretary, N. G. Livermore; Treasurer, Walter Wood; Superintendent, R. W. Meredith; Directors, George B. Langley, George Wood, Walter Wood, W. D. Kemble and Francis Reeves.

THE Consolidated Gas Company, of Baltimore, is experimenting with lamps of the Siemens-Lungren-Gordon type for street lighting, and the results so far are said to be satisfactory. Ten lamps have been located, on Madison avenue, between Biddle and Laurens streets, and we are informed that that installation is to be duplicated in another part of the city. The Company offers to maintain them at an annual charge of $60 each. Each public arc light, under the present contract, costs the city $127.75 per annum.

PROF. BARRETT, Chief of the Electric Department for the proposed World's Fair, Chicago, has made public the following classification arrrangement of the electrical exhibits. The department is arranged in 19 groups, divided into 54 classes, a number of the latter being subdivided. The groups are thus catalogued: (1) Apparatus to illustrate the phenomena and laws of electricity and magnetism; (2) electric batteries, primary and secondary; (3) machines and appliances for producing electrical currents by mechanical power—dynamical electricity; (4) commercial transmission and regulation of the electrical currents; (5) electric motors; (6) application of electric motors; (7) lighting by electricity, the arc system; (8) lighting by electricity, the incandescent system; (9) heating by electricity: (10) electro-metallurgy and electro-chemistry; (11) electric welding, stamping, temporing brazing, etc. (12) electric telegraph and signals; (13) the telephone and its appliances; (14) the phonograph; (15) apparatus for electrical measurement: (16) electricity in surgery and therapeutics; (17) miscellaneous applications of electricity; (18) history and statistics of electrical inventions; (19) progress and development in electrical science and construction as illustrated by patent models of various countries.

IN the suit of H. L. Bradin against the authorities of Crawfordsville, Ind., at the inception of which a temporary injunction was issued in restraint, a further decision has been promulgated. The court decided to modify the injunction decree to the extent that the authorities may install and operate a plant capable of lighting the streets and public buildings, but shall not undertake to supply currents for any other purpose.

RECENT advices from Akron, Ohio, are to the effect that the Akron Light, Heat and Power Company instituted a new rate on the first inst., based on the following plan: Those who use the gas for fuel or for lighting and fuel purposes are to be billed at 30 cents per 1,000 cubic feet, net, accounts to be closed before the 10th of month in which bills are rendered. Where the gas is used for illuminating purposes only, the prior rate of 50 cents per 1,000 (less 10 off for prompt payment) is to rule.

A CORRESPONDENT at New Orleans writes: "Some time ago you made a note respecting the suit of P. L. Fourchy against the Gas Company, and as that suit was decided last week I send you the gist of the decision. To a better understanding of the case, I repeat the main facts at issue. Some weeks ago Fourchy instituted suit in the Civil District Court to compel the New Orleans Gas Light Company to recommence the supply of gas at his office, which supply had been discontinued because of his failure to pay a gas bill (amounting to $4.14) that had been left at his office on January 9th by a collector in the employ of the Company. Fourchy testified that for two years the Company held on deposit $5 given by him as security for the payment of gas consumed by him, that the interest thereon had not been drawn, that he was anxious to pay his indebtedness to the Company, but that he declined to pay the amount over the Company's counter, as the time taken up in such visit would be entirely lost to him. The Company urged that it had complied with its duty in that its collector called on Mr. Fourchy, but failed to receive the money due, wherefore defendant held that complainant was not put to undue hardship at being obliged to pay at the Company's office over its counters. Judge Rightor decided that the Company was in error over shutting off the gas, that the supply must be recommenced, that it must go into court (the sum in dispute was paid into court before the case was tried) to collect the Fourchy back debt, and that it also should bear the costs of the suit.—CRESCENT."

A. M. WORTHINGTON, Secretary of the Covington (Ky.) Electric Light Company, asserts that the recent rumors concerning its possible absorption by the Gas Company are utterly void of truth. On the other hand, we are informed on good authority that it is only a question of time when the interests will be merged.

THE new gas holder for the Norwalk (Conn.) Company is to be located on what is known as the Besse property. The tank is to be 75 feet in diameter.

THE New Haven (Conn.) Company will enlarge its carbonizing capacity.

THE judgement in the suit of Mrs. Harriet Schwab against the Jersey City (N. J.) Gas Light Company, under which plaintiff was awarded damages in the sum of $6,000 for injuries received by her some time ago, because of an explosion of gas in the cellar of her residence, has been affirmed in the Supreme Court, on appeal. This ends the case.

LIGHT INSPECTOR MELOY, in his report to the Council Committee on Light, Minneapolis, Minn., said that an unusually large number of gas lamps and gasoline lights were reported "out" during the month. He further said that the Company supplying the gasoline illumination deducted the cost of the "outs" from the wages—$45 per month—of the lamplighters, whereas the Gas Company charged the cost to profit and loss, in the belief that its employees were honest and lighted all the lamps, the subsequent extinguishments being due to accident.

THE proprietors of the Olympia (Wash.) Gas and Electric Light Company have ordered a reduction in the gas rate from $3 to $2.50 per 1,000 cubic feet.

THE Citizens Fuel Gas Company, of Terre Haute, Ind., have determined to make no charge for putting in consumers' services. In the meantime, Mr. Diall, of the old Company, is going along in the even tenor of his way, enjoying a good business and an easy conscience.

A MOVEMENT to establish a gas works at Niles, O., is under way, and although the scheme calls for the investment of something less than $15,000, the situation looks a promising one. Niles is about 9 miles northwest of Youngstown, and is on the Mahoning river, at a point 57 miles east and south of Cleveland. It has coal and iron mines, and several manufactories. Population, about 4,200.

THE Baltimore Electric Refinery Company has awarded contracts for the construction of its plant to the Berlin Iron Bridge Company, of East Berlin, Conn. The structures comprise a rolling mill, 56 by 180 feet; a refinery building, 80 by 130 feet; and a boiler house, 49 by 55 feet.

MR. I. LINTON, President of the Ravenna (O.) Gas and Electric Light Company, is dead. He was also Consulting Civil Engineer for the Cleveland and Pittsburgh Railroad.

THE San Francisco offices of the Westinghouse Electric Company have been closed.

THE Board of Trustees, of Clyde, N. Y., have entered into a contract with the local electric lighting company, under which the latter agrees to maintain 33 high candle power arcs, on 26 nights of each month—lights to be started at sundown and extinguished at 1 A. M.—for a total annual payment of $1,980.

THE authorities of Portsmouth, N. H., are nibbling at a proposition (recently submitted them) to substitute incandescent electric lights (16-candle power) for the gas and naphtha lamps now used in the public illumination. The plan is to employ not less than 145 lamps (on the basis of a 3-year contract), and keep the same on duty 20 nights each month, the payment rate to be 6 cents per light per night.

JOHN LANGDON, of the Danbury (Conn.) gas works, while making a tour of the premises one night last week, accidentally overturned a pail of tar. He stumbled, lost his balance and fell in the blazing mass, the combustible having been ignited from the light in the hand lantern that he carried. His injuries resulted fatally.

THE Willamette Falls Electric Light Company is to light the public lamps in Portland, Oregon. The contract calls for 100 arcs (2,000 candle

power), at $9.72 each per month, and 800 incandescents (25-candle power), at $1.98. An all night and every night table is to be followed.

MAYOR-ELECT STUART, of Philadelphia, having publicly stated that he would not reappoint General Wagner to the post of Director of Public Works, the slate makers at once jumped to the conclusion that that mantle of authority would likely be wrapped around the shoulders of General H. S. Huidekoper. It seems, however, that the General prefers his present position with the American Bell Telephone Company, which is not to be wondered at when one recalls the fact that his present salary is greater than that paid to the incumbent of the Public Works direction. Again, it may be taken for granted that no man can give satisfaction to all the interests concerned in the Public Works department. The gas works division thereof would alone be sufficient "to put a man out with his party."

IT is said that the Phillipsburg (Pa.) Gas Company will remodel its plant to adopt it to the manufacture of water gas.

A ST. LOUIS correspondent, writing under date of March 28th, forwards the following: "The case of Pierre Choteau against the St. Louis Gas Light Company for $1,124.30, which plaintiff claimed to have paid the defendant by mistake, has been decided by Judge Klein, who directed that a judgment be entered in favor of the Company. Mr. Choteau had been charged with the gas bills for the Olympic Theater, from 1885 until 1889, and during all that time the gas consumed on three floors of the St. James Hotel passed through one of the three meters in the theater building. The bills had been paid by Mr. Short, as agent for Manager Spaulding, and then charged against Mr. Choteau as expenses. The defence claimed that Mr. Choteau paid them no money, and that if he had any action it was against Mr. Spaulding. It was shown on the trial of the case that the proprietors of the theater building had four gas meters put in the building in 1882, three of which were known as theater meters, and one as the St. James Hotel meter. The accounts for the three were kept in the name of the Olympic Theater, and the bills were paid by Mr. Short without question, till December, 1889, when he informed the Company that one of the meters was supplying gas to the hotel. It was further shown that in October, 1888, the pipe of the hotel meter was in some mysterious manner attached to one of the theater meters, thereby increasing the amount of free gas that the hotel was receiving. This fact the Gas Company claimed was, if not actually within the knowledge of Mr. Choteau or those under whom he claims, peculiarly within their reach and not at all within the province of the Company to investigate or meddle with. The Company added that in supplying the gas in question it 'made no mistake and labored under no false impression whatever; indeed it was not entitled to have impressions on the subject: The interior arrangements or apportionments of a building for lighting purposes, its shifting occupancy of rooms from one tenant to another are things which it has nothing to do with until application is made for a new arrangement of meters. The Olympic Theater was the original applicant for this meter in the year 1882. It never surrendered it until December, 1889 but on the contrary affirmed its continued use of the same from week to week by accepting and paying the bills for gas.' The Company's case was argued by Mr. Henry Hitchcock."

SOME time ago we reported that a suit had been instituted for damages, against the Louisiana Electric Light Company, of New Orleans, by the parents of Joseph Clements, who lost his life from a shock sustained through contact with a "live" light wire of the Company. The case came to trial in due time, before Judge King and a jury, and when the testimony was all in the jury gave plaintiffs a verdict for $5,000—the damages were originally assessed at $20,000. The evidence showed that Clements, who was a roofer, had occasion in his ordinary duties, to make some repairs to the roof of a gallery, at the corner of Camp and Gravier streets, New Orleans, and while at work attempted to cross under a wire of the Company running over the roof, at a height of less than four feet. Contact with Clements body was made at a point where a second wire crossed the first, and at the joining point the insulating material was worn off by the friction of the wires. Plaintiffs further asserted that the Company was all the more culpable from the fact that the current was permitted to remain "on" at a time when its lights were not needed. The Company offered the defence that deceased did not exercise a proper amount of caution in avoiding the wire, hence his death was caused by his own negligence.

THE Framingham (Mass.) *Tribune*, speaking of the operations of the new fuel gas plant in South Framingham, says: "The new gas system has now been in operation at South Framingham for several weeks, and is giving good satisfaction. The light is admired, the heater stoves are found to be convenient and inexpensive, and there promises to be a good demand for gas cooking ranges, those now in use giving good satisfaction. Within the few weeks since the system was put in operation the gas has come to be used for tailor's irons, soldering furnaces, photographer's burnishing machines, druggist's cigar lighters, restaurant hot griddle plates, tea and coffee boilers, besides the usual lighting, heating and cooking operations in ordinary households."

THE capital stock of the Olean (N. Y.) Electric Light and Power Company is to be increased from $25,000 to $30,000.

THE following particulars respecting the decision in the case of the Jersey City Gas Light Company vs. the United Gas Improvement Company are likely to be of interest: "Judge Edward T. Green has filed an opinion in the United States Circuit Court, in the case of the Jersey City Gas Light Company vs. the United Gas Improvement Company, which contains an important construction of the Act of April 18, 1884, imposing State taxes upon certain corporations. The plaintiff Company is a corporation existing under an act of incorporation of the State, approved in 1849. The defendant was a rival corporation existing under the laws of Pennsylvania, but doing business in the same city. In December, 1884, the plaintiff and defendant entered into a contract by which the former leased to the latter, for a term of 20 years, works and property in Jersey City at an annual money rental. The lease contained a condition that all assessments and taxes levied upon the real and personal property, franchises, capital stock or gross receipts should be paid by defendant. The entire controversy is over this condition. The defendant has paid all the taxes except those levied by the Legislature under the Act of 1884, and these, the defendant claims, do not fall within the terms of the contract, because it is not a tax on either the real and personal property, franchises, capital stock or gross receipts of the plaintiff. On the other hand, the plaintiff contends that this is clearly a tax upon its franchise. After discussing the various sections of the law relating to the case, Judge Green finds this to be a fair and reasonable construction of the Act: That while it apparently imposed upon certain corporations, of which the plaintiff is one, a tax *eo nomine*, its object is to exact a license fee for the use of franchise heretofore granted. And this construction is entirely in harmony with that adopted by the highest courts of the State of New Jersey. If this tax is a license fee it follows that it cannot be a tax upon franchise. In the one case it is exacted without regard to the value of the franchise, and is paid only for the use and enjoyment of the franchise. In the other, it must be assessed upon franchise as a thing of value, whose value can be ascertained accurately. For it is settled in New Jersey that a franchise is property, and as such, when it is to be taxed, its true value must be arrived at as the basis of its settlement. For, as it is property, it falls directly under the protecting clause of the constitution, that 'property is to be assessed by general laws and uniform rules according to its true value.' But nowhere in the Act of 1884, taxing these corporations, is there specified or designated or suggested any method or scheme whereby the value of their franchise can be ascertained. Nor is their value in any degree taken into account in fixing the license fee. That is done arbitrarily by the Legislature without the slightest regard for the value of a franchise as a franchise, in other words, as property. To hold, therefore, that this Act imposes a tax upon franchises which are property, is to declare that the Act contravenes the constitution in one of its most important provisions. It follows, from this conclusion, that, as defendant has not contracted to pay license fees exacted of the plaintiff corporation, judgment must be for it."

THE capital stock of the Denver (Col.) Gas Company has been increased from $700,000 to $1,050,000.

THE proprietors of the Gloversville and Johnstown (N. Y.) Gas Company have put their rate to the city at $1.50 per 1,000, and to ordinary consumers at $1.60.

THE scheme of improvement contemplated on the works and mains of the Columbus (Ga.) Gas Light Company will involve an expenditure of $20,000, and work on the same will be begun at once.

MAYOR ROWE, of Fredericksburg, Va., at the instance of the City Council, has appointed Messrs. W. I. King, James S. Knox, W. E. Bradley, M. G. Willis, and John T. Knight a committee to ascertain the cost of installing a gas plant to be operated on municipal account, with instructions to report back as speedily as consistent with the business in hand.

THE AMERICAN GAS LIGHT JOURNAL

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APRIL 6.

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	Capital.	Par.	Bid	Asked
Consolidated	$35,430,000	100	97	98
Central	500,000	50	90	100
" Scrip	220,000	—	95	100
Equitable	4,000,000	100	116	118
" Bonds	1,000,000	—	113	115
Harlem, Bonds	170,000	—	—	—
Metropolitan, Bonds	658,000	—	110	115
Mutual	3,500,000	100	119	120
" Bonds	1,500,000	—	100	102
Municipal, Bonds	750,000		—	—
Northern		50	—	—
" Bonds	150,000	—	—	100
Standard Gas Co—				
Common Stock	5,000,000	100	—	48
Preferred	5,000,000	100	—	90
Yonkers		50	112	—
Richmond Co., S. I.	346,000	50	—	—
" Bonds	20,000	—	—	—
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	117	120
Citizens	1,200,000	20	88	90
" S. F. Bonds	320,000	1000	100	103
Fulton Municipal	3,000,000	100	130	132
" Bonds	300,000		10)	105
Peoples	1,000,000	10	88	90
" Bonds (7's)	368,000	—	100	—
" " (6's)	94,000	—	100	—
Metropolitan	870,000	100	100	105
" Bonds (5's)	70,000	—	—	—
Nassau	1,000,000	25	134	—
" Ctfs	700,000	1000	100	103
Williamsburgh	1,000,000	50	130	—
" Bonds	1,000,000	—	108	112
Out of Town Gas Companies.				
Boston United Gas Co.—				
1st Series S.F. Trust	7,000,000	1000	—	87¼
2d " "	3,000,000	1000	74½	76
Bay State Gas Co.—				
Stock	5,000,000	50	61½	62
Income Bonds	2,000,000	1000	95½	—
Buffalo Mutual, N. Y.	750,000	100	105	110
" Bonds	200,000	1000	95	100
Citizens, Newark	1,000,000	50	155	160
" " Bonds	45,000	—	—	—
Chicago Gas Company	25,000,000	100	43⅜	43⅝
Chicago Gas Light & Coke Co.—				
G't'd Gold Bonds	7,650,000	1000	87	88½
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1000	—	98
People's Gas and Coke Co., Chicago—				
1st Mortgage	2,100,000	1000	—	100
2d "	2,500,000	1000	94	98½
Consumers Gas Light Co., Jersey City	2,000,000	100	12	15
Bonds	600,000	1000	70	75
Cincinnati G. & C. Co.	6,500,000	100	204	205
Consumers Toronto	1,000,000	50	190	200
Central, S. F., Cal.			92	100
Capital, Sacramento, Cal			58	
Consolidated, Balt.	11,000,000	100	47⅝	48
" Bonds	6,400,000		107	107½
Citizens Gas Lt. Co., Rochester, N. Y.	500,000	—	85	110
Bonds	250,000		—	—
East River Gas Co., Long Island City	1,000,000	100	100	105
Bonds	500,000	100	100	102
Hartford, Conn.	750,000	25	102	108
Jersey City	750,000	20	165	170
Louisville, Ky.	2,570,000	50	125	130
Little Falls, N. Y.	50,000	100	—	100
" Bonds	25,000	—	100	103
Laclede Gas Light Co., St. Louis, Mo.—				
Common Stock	7,500,000	100	15	17
Preferred "	2,500,000	100	45	52
Bonds	9,034,400	1000	77½	78
Montreal, Canada	2,000,000	100	200	208
Memphis (Tenn.) Gas	750,000	100	40	—
" Bonds	240,000	100	103	—
New Haven, Conn.		25	200	—
Oakland, Cal.			34½	35½
Peoples, Jersey City		—	60	61
" " Bonds			—	—
Paterson, N. J.		25	99	102
Rochester, N. Y.		50	99	100
Syracuse, N. Y.	500,000	25	—	—

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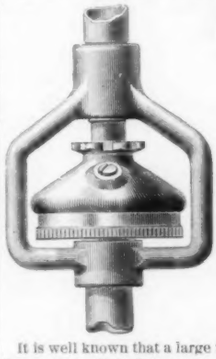

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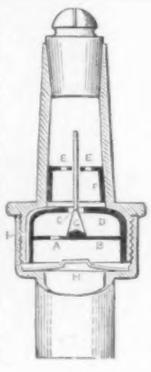

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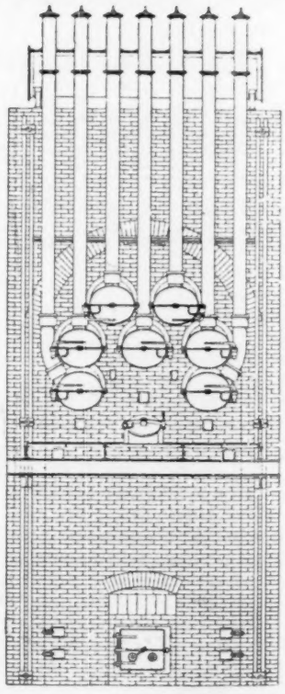

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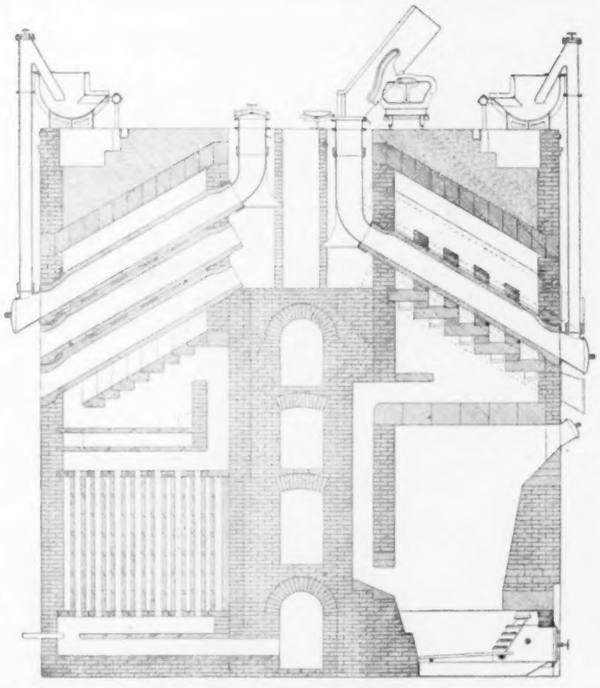

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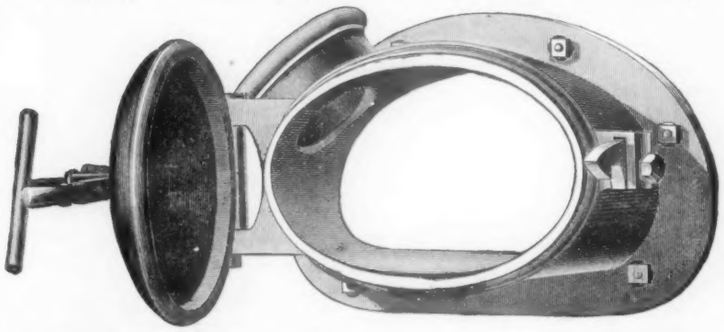

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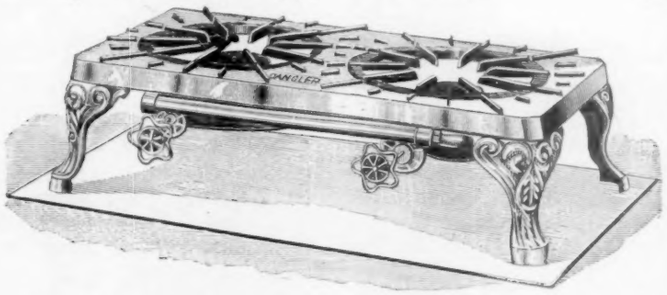

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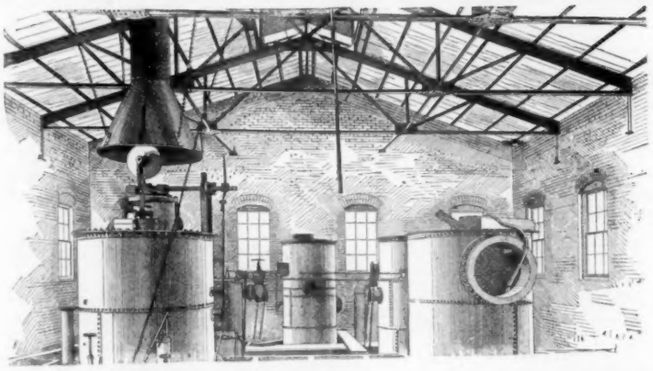

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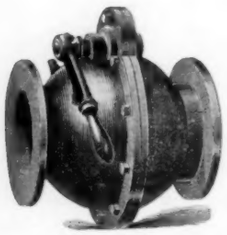

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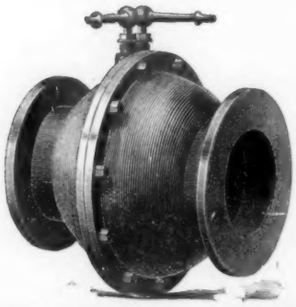

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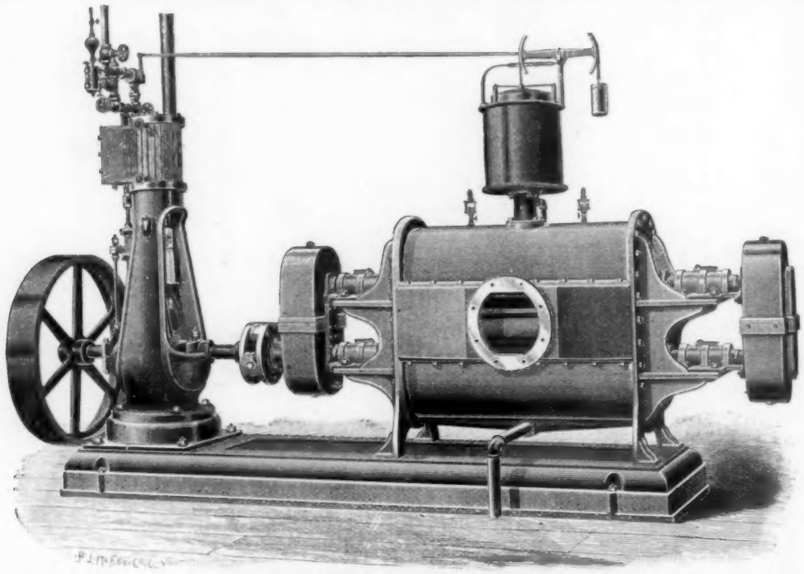

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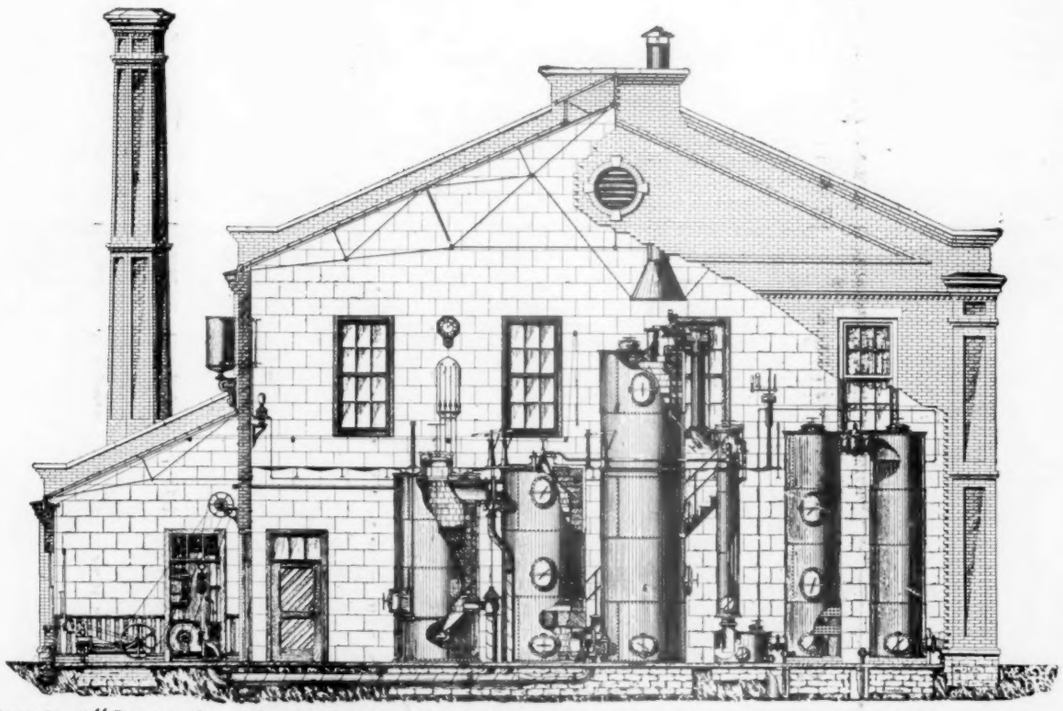

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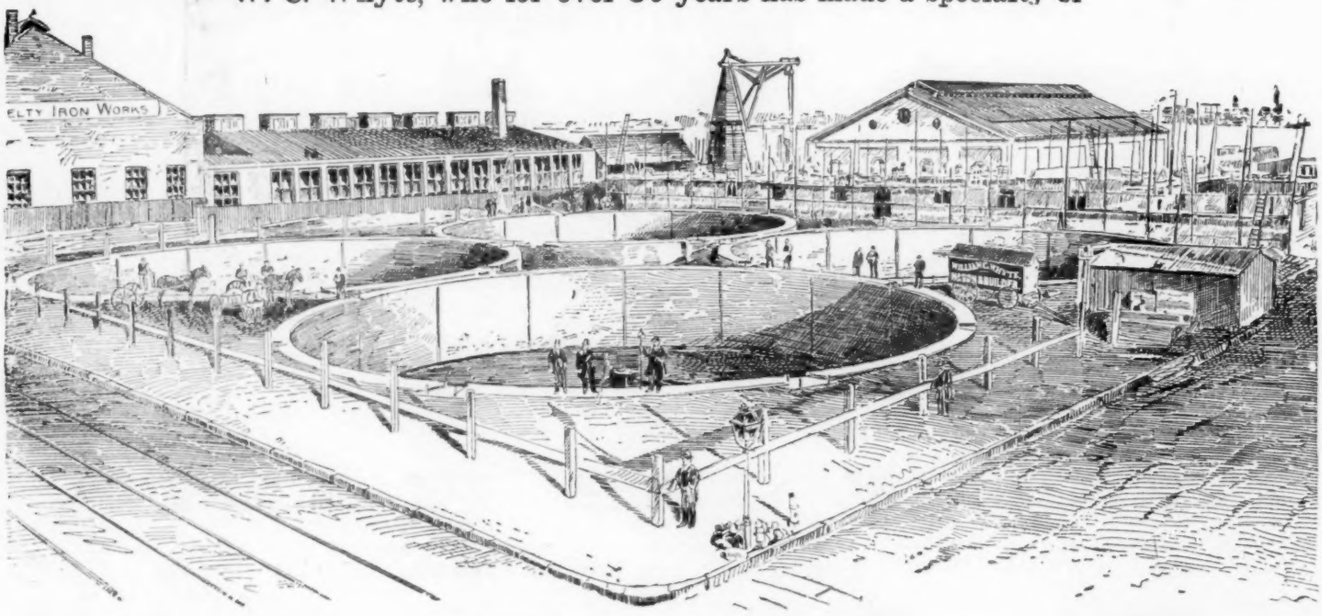

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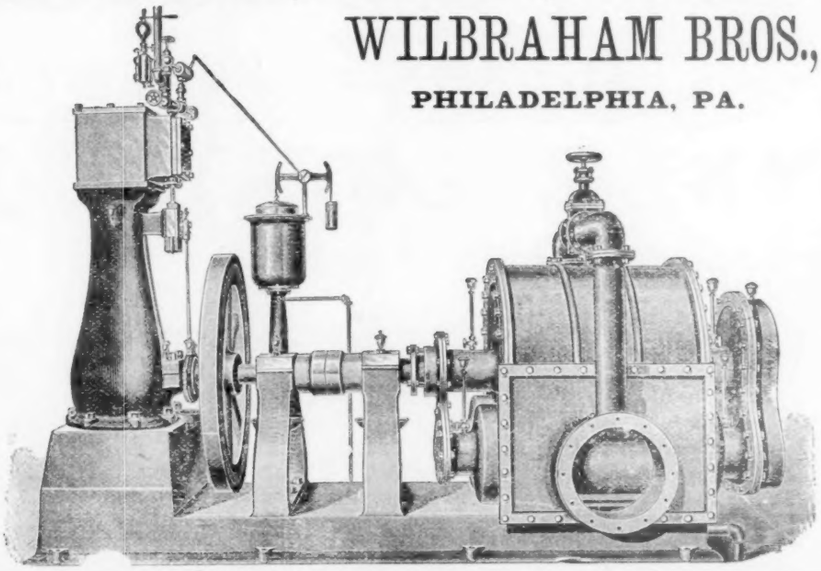

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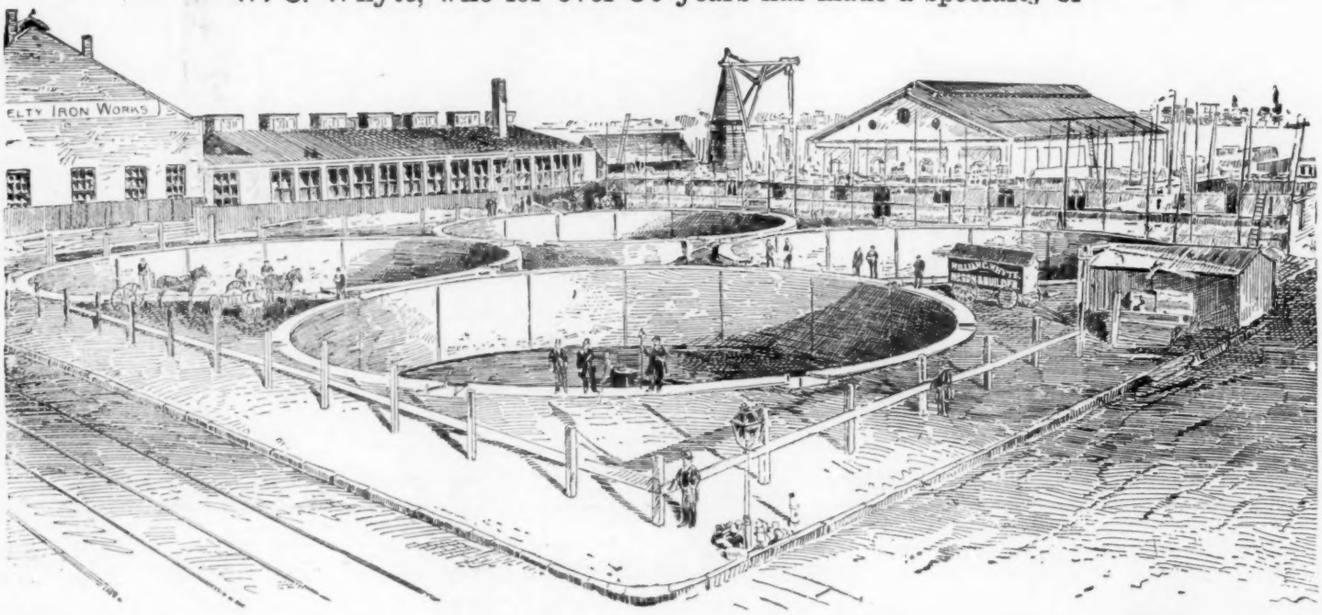

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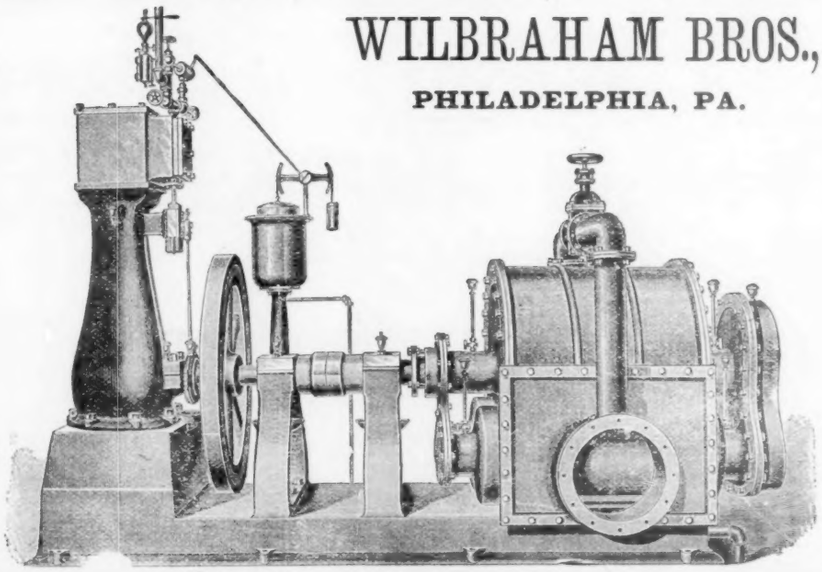

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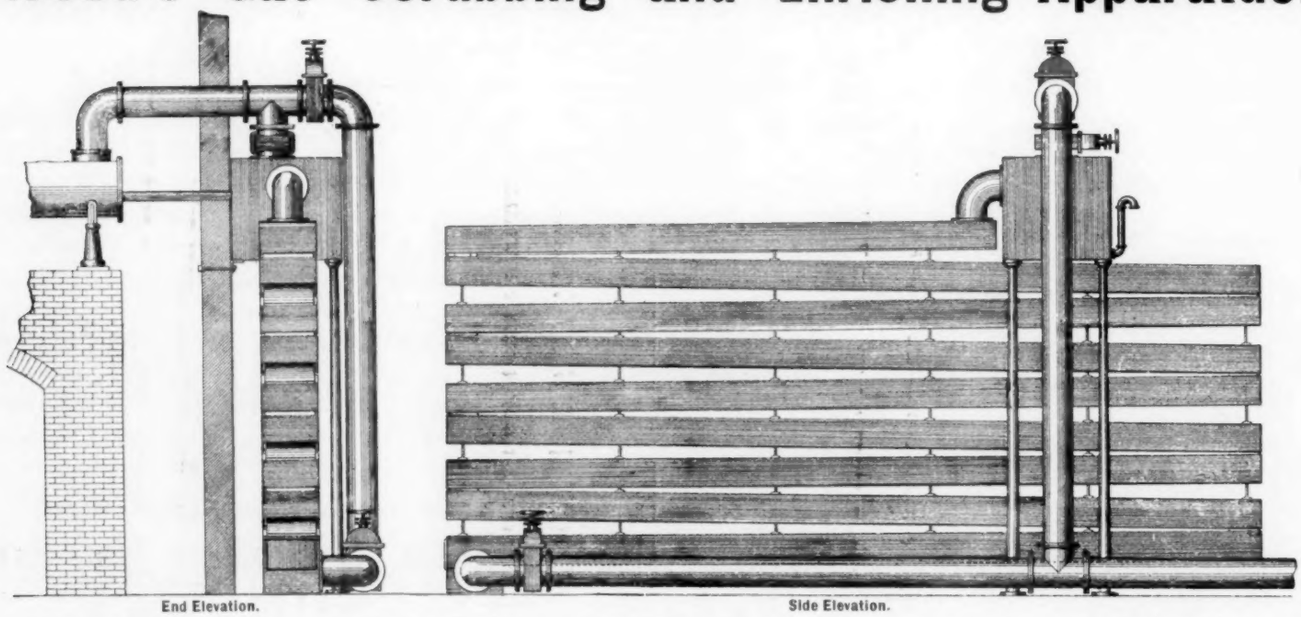

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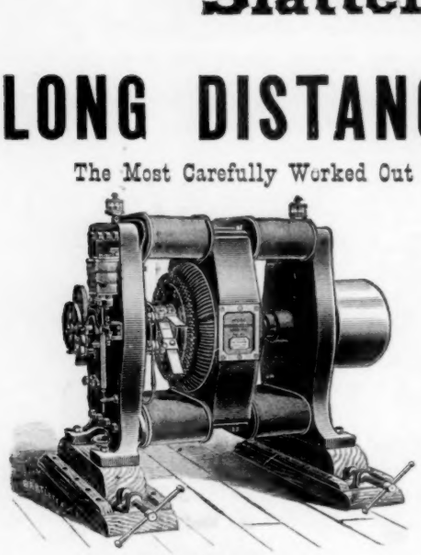

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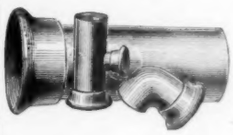

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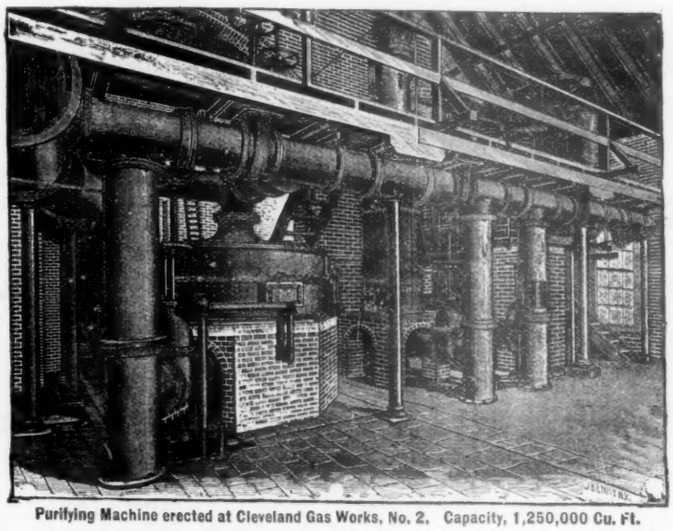

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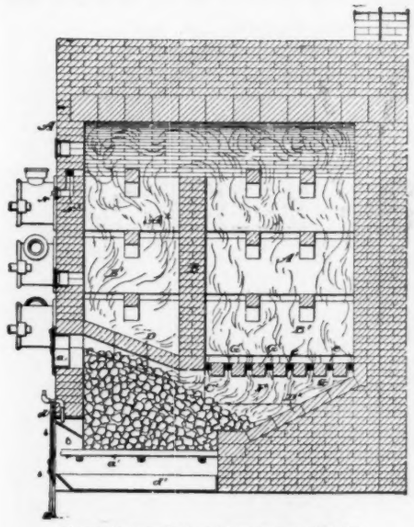

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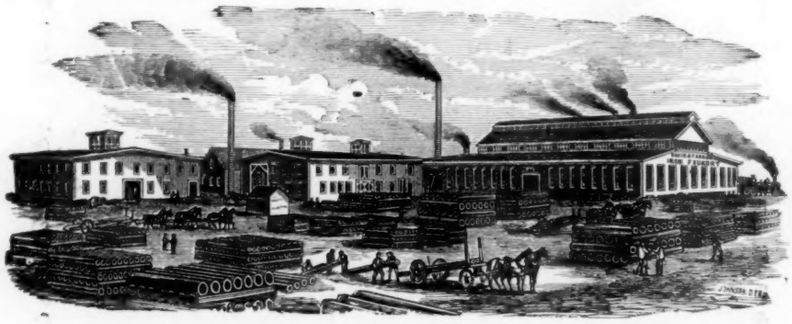

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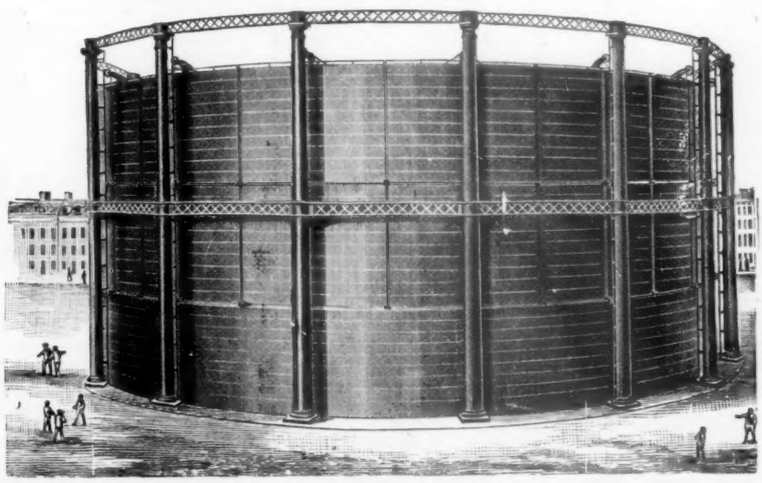

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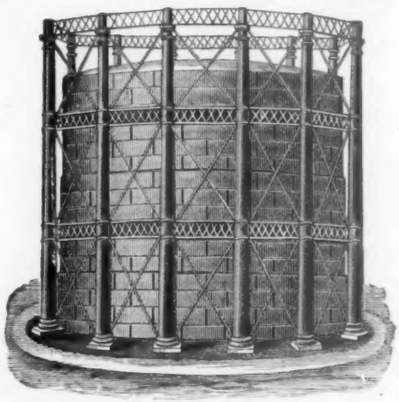

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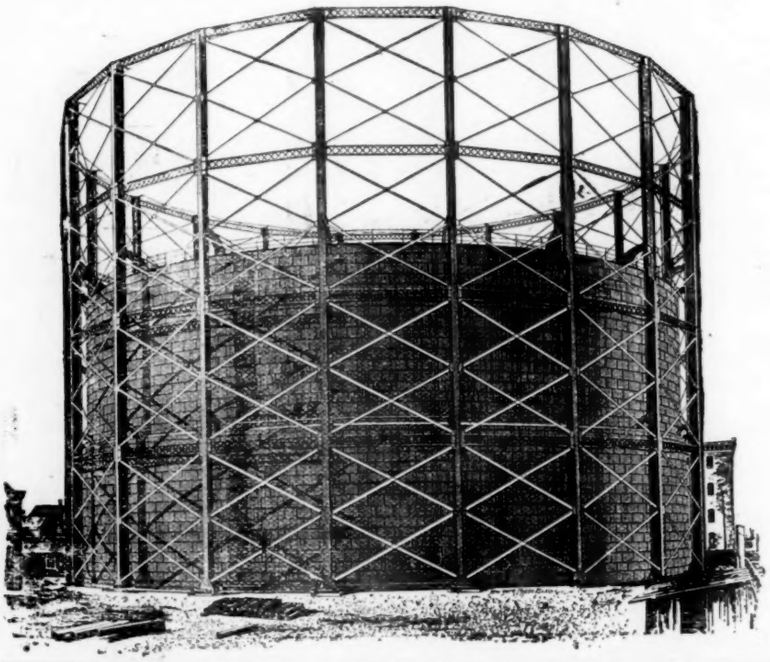

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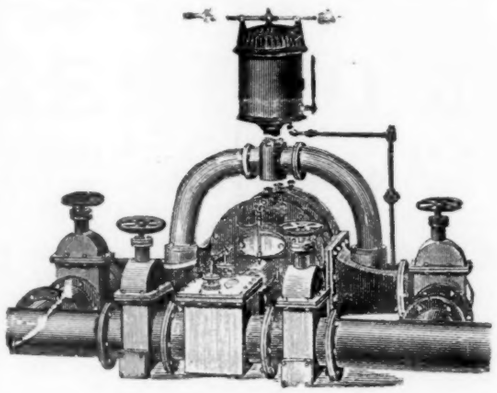

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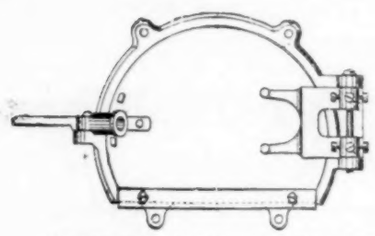

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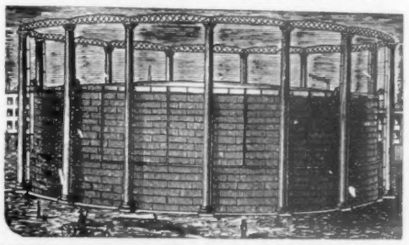
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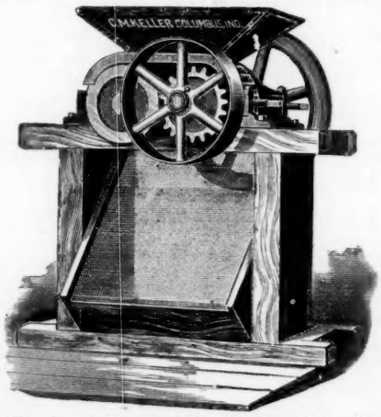

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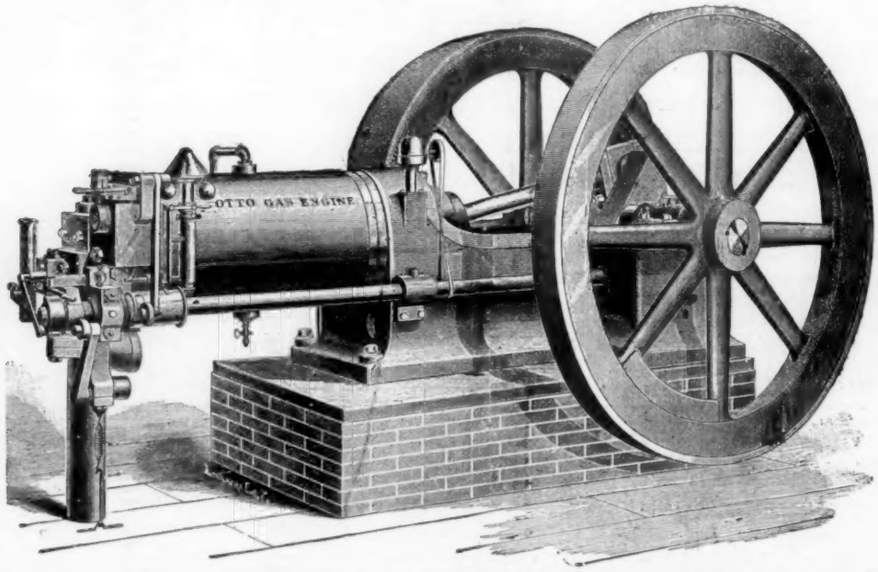

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